

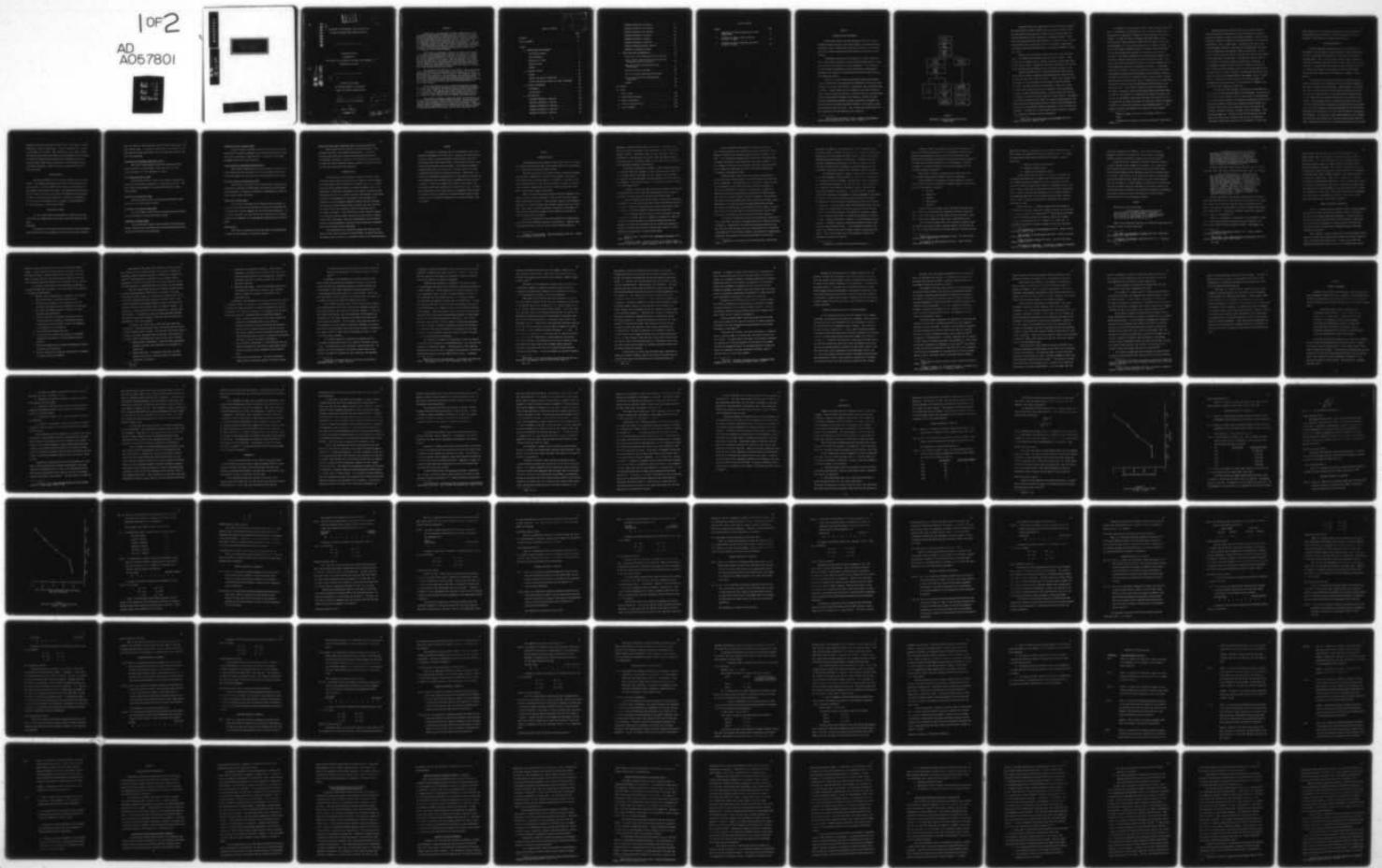
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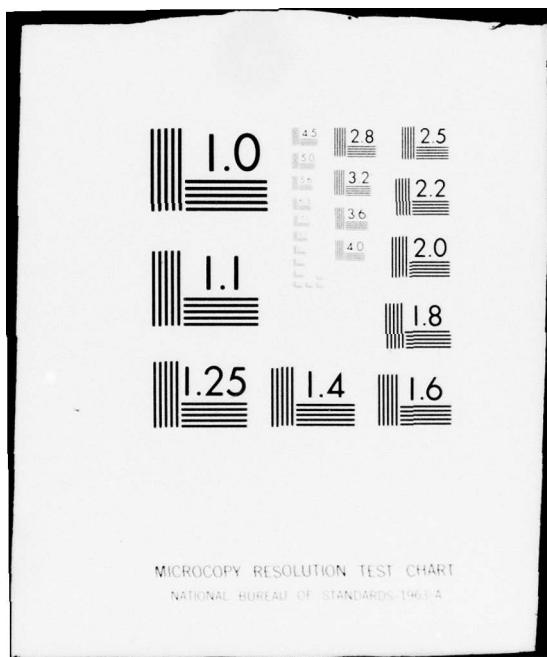
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AN ANALYSIS OF MAINTENANCE SERVICE CONTRACTING AT NAVY AND MARI--ETC(U)  
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⑥ AN ANALYSIS OF MAINTENANCE SERVICE CONTRACTING  
AT NAVY AND MARINE CORPS SHORE ACTIVITIES

A Research Project

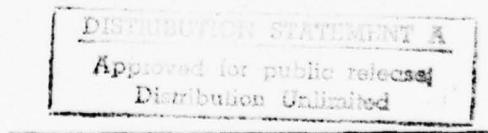
Presented to

the Faculty of the School of Business and Management *new*  
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⑦ Master's Thesis

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Business Administration



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## ABSTRACT

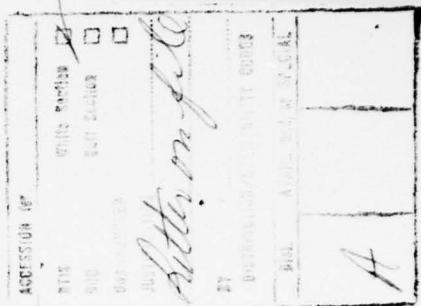
Historically, the Department of Defense (DOD) policy in construction and maintenance of station and base facilities has been to accomplish routine recurring maintenance with civil service employees and new construction and major work by contract. Prior to the war in Viet Nam, most stations and bases were staffed on this basis. The post-Viet Nam era has seen a steady decline in the number of civil service employees working for DOD. This steady reduction has resulted in a need to accomplish by maintenance service contract larger and larger quantities of routine recurring base maintenance previously accomplished by the civil service employees.

This study was undertaken to analyze the impact this growing utilization of maintenance service contract is having on the ability of the activity Base Maintenance or Public Works Officer to properly execute his responsibilities for satisfactory facilities maintenance. The problem question is as follows: What relationship if any exists between the need for an expanded contract administration organization and the degree of Public Works Officer satisfaction with maintenance service contractor performance at Marine Corps Air Station El Toro and other Navy and Marine Corps activities?

The hypothesis for this study is as follows: The growing trend toward utilization of the maintenance service contract is a fact at Marine Corps Air Station El Toro as well as a large number of other Navy and Marine Corps activities. The magnitude is such that the absence of appropriate organizational resources to administer the contracts is resulting in maintenance service contractor performance that is marginal or unsatisfactory as evaluated by the activity Base Maintenance or Public Works Officer.

The research design was built around selecting those factors considered most relevant to maintenance service contractor performance at Marine Corps Air Station El Toro and exploring their relevance at other activities. The comparison was drawn based on the opinion of the individual Public Works Officers at the participating activities. The vehicle for data collection was an eighteen-item questionnaire.

Data analysis revealed a significant amount of attitudinal consistency among the Public Works Officers surveyed. Enough consistency in many cases to propose certain activity-level actions which would lead to improved maintenance service contractor performance. Additional findings led to recommendations for further study and proposed actions at DOD organizational levels higher than the base and station level.



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## Chapter 1

### INTRODUCTION AND BACKGROUND

Public Works Officers and Base Maintenance Officers at Navy and Marine Corps activities in the United States and overseas have had available to them in recent times contracting authority to accomplish, *inter alia*, routine recurring base maintenance by maintenance service contract.

The McNamara-O'Hara Service Contracts Act of 1965, amended in 1972, is the current legislation authorizing government agencies to contract for the time and effort of service employees.<sup>1</sup> The ability to use this statute to accomplish routine recurring base maintenance is essentially an extension of resources for the activity Public Works or Base Maintenance Officer.

Figure 1 is a simplified organizational diagram which depicts lines of authority for the operations and maintenance of facilities and utilities at military installations, in particular, Navy and Marine Corps activities. Simply stated, the line commanders, both Navy and Marine Corps, exercise resource allocation in terms of operation and maintenance dollars and personnel allowances, while the Navy, through the Naval Facilities Engineering Command, provides construction management and base facilities maintenance management technical staff support to both Navy and Marine Corps activities. This includes the administration of both construction and maintenance service contracts.

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<sup>1</sup>United States Department of Labor, A Guide to The McNamara-O'Hara Service Contract Act of 1965 (April, 1968), p. 1.

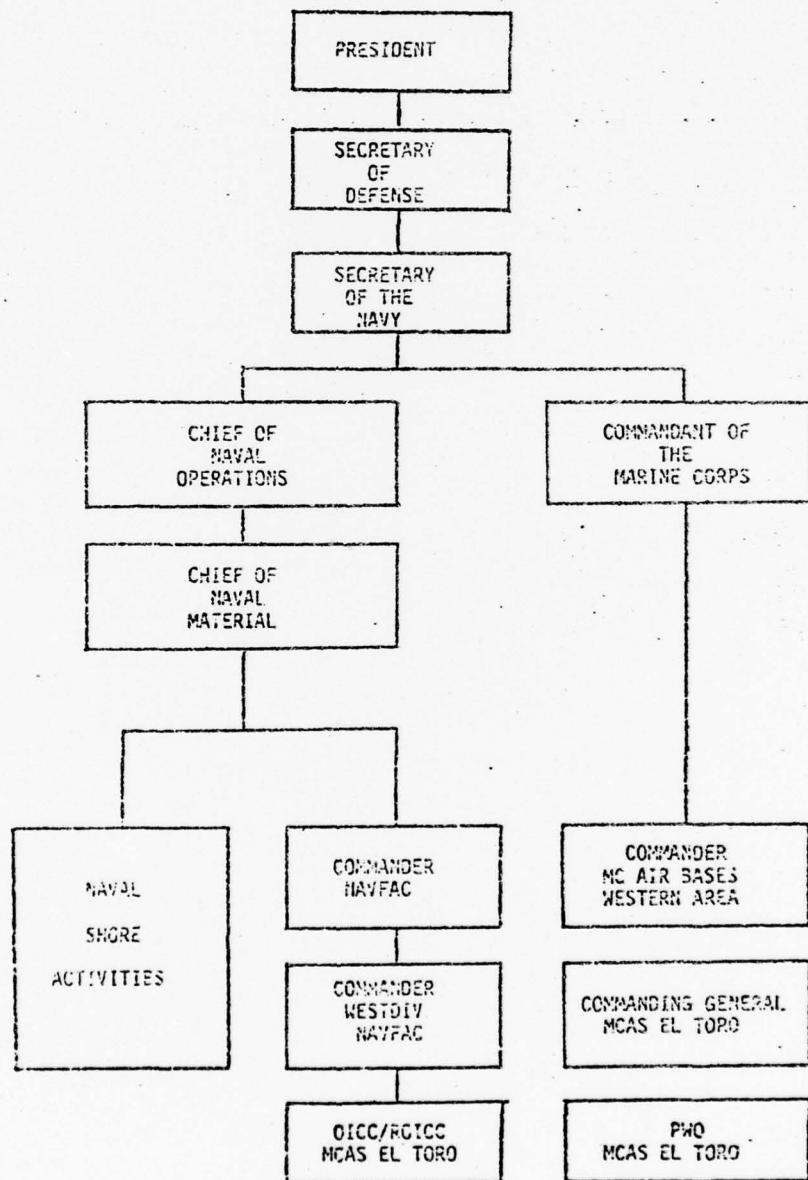


Figure 1  
Department of Defense Organizational Chart  
(Simplified)

Traditionally and not surprisingly the number of people employed by the Department of Defense (DOD), both military and civilian, swells to large numbers during periods of armed conflict and then reduces to numbers substantially lower in post-war or peacetime periods.<sup>2</sup> These peaks and valleys describing DOD strengths as a function of time are tempered by many factors such as the size of the conflict, congressional attitudes, current administration policy, and public sentiment, to name just a few.

During a post-war period or during the time of the "reduction mode," all elements of the defense structure feel the impact. These periods can be compared with an economic recessional period experienced by the private sector, although the sinusoidal variations of the private sector and defense establishment do not necessarily coincide in time.

During these DOD post-war "recessional periods" those dollars and personnel devoted to operating and maintaining the military installations take their fair share of the cuts. In most cases, however, the same number of facilities and utilities remain as part of the DOD facilities inventory and have to be maintained. There are, in fact, actions to close bases but the rate of reduction of base maintenance personnel and base maintenance dollars is always greater than the rate of reduction of those facilities remaining in the inventory. Accordingly, in this DOD recessional period there is an ever-increasing need for the Public Works or Base Maintenance Officer to rely on the maintenance service contract to accomplish necessary maintenance of his facilities and utilities. In effect, he is utilizing the service contract to increase or to extend his resources for base maintenance.

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<sup>2</sup>Merze Tate, The United States and Disarmament (New York: Russell and Russell, 1948), p. 249.

In addition to the peaks and valleys in DOD strengths precipitated by U. S. involvement in armed conflict, there is another agency-level force which has substantial influence on the utilization of the service contract. In 1966 the Office of Manpower and Budget (OMB) issued a policy directive which essentially stated that the agencies of the federal government will rely on the private sector to supply its needs. In effect, the federal government desires to contract with private enterprise to the maximum extent possible for the goods and services it requires.<sup>3</sup> The federal government has classified these commercial and industrial products and services into over 100 functional areas. Commercial and industrial products and services are those products and services produced by commercial or industrial activities. A government commercial or industrial activity is one which is operated and managed by an executive agency and which provides for the government's own use a product or service that is obtainable from a private source.<sup>4</sup> Many of these functional areas are those which, if contracted for or bought from the private sector, would be acquired through the utilization of the service contract. In an effort to enforce the policy guidance from 1966, OMB has devised a sophisticated system requiring government agencies who use the hundred or so commercial and industrial products and services to periodically review these functions and determine if it is more economical to acquire the product or service by contract as opposed to doing it in-house with employees on the government payrolls. This system is known as the commercial and industrial review process.<sup>5</sup>

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<sup>3</sup>Bureau of Budget, Circular No. A-76 (March, 1966), p. 1.

<sup>4</sup>Ibid.

<sup>5</sup>"Commercial and Industrial Activities Overview," ALM 39-4013-LC(B), p. 1.

Beginning with the post-Viet Nam era circa 1970, activities within the defense establishment have been experiencing a continuing year-to-year decline in number of government employees. There has been similarly a decline in operation and maintenance dollars for facilities maintenance as well as other things. Concomitant with the post-war defense manpower shrinkage is the parallel force generated by the OMB policy on commercial and industrial products and services. The end result is that in the past five to seven years the activity Public Works Officers have been in a position of expanding utilization of the service contract to accomplish routine recurring base maintenance. It is reasonable to expect that this trend will continue and intensify unless the United States becomes active in some sizable armed conflict or unless there is a major attitudinal change toward the defense structure on the part of the administration, the congress, and U. S. public opinion. Hopefully the first reason will not be the catalyst for changing this trend and if such is the case then it is doubtful that those attitudinal changes will take place.

For the Public Works Officer, utilization of the maintenance service contract has both advantages and disadvantages. On the positive side for the service contract it can be less costly to the government; it can relieve the government of equipment maintenance and material purchasing requirements by having the contractor do those things; the personnel used by the service contractor do not count against the activity's personnel allowance, and other similar advantages. There are disadvantages too: the Public Works Officer generally has less control over the service contractor than over his own employees; contractor responsiveness particularly to emergencies in most cases

cannot match that of the in-house organization; contract administrative procedures make it difficult to enforce quality work from the contractor if that quality is lacking from the start.

#### THE RESEARCH PROBLEM

At Marine Corps Air Station (MCAS) El Toro, California, the dependence on and utilization of the maintenance service contract over the past few years have been essentially consistent with the trends described above. That is to say, there has been a yearly increase in both number of service contracts and total dollar volume spent on these contracts. The reasons for this increasing trend in usage of the service contract can largely be attributed to the post Viet Nam DOD mandated personnel reductions and the commercial industrial review process.

During the past two years the quality of performance by the various maintenance service contractors at El Toro could be generally described as marginal to unsatisfactory. Unsatisfactory in the sense that the Public Works Officer feels he could accomplish the same service work by in-house forces in a more effective and responsive way and for roughly the same number of dollars that he is paying his contractor. The maintenance service contracting experience during this time frame could further be described as representing 10 to 15 percent of the facilities operation and maintenance budget of the Public Works Department but representing a far more sizable portion of the problems for management. For these basic reasons much managerial time, thought, and effort have been expended over the past eighteen months exploring what if anything could be done to improve the performance of the various

maintenance service contractors at MCAS El Toro. This paper is a manifestation of a part of that effort. The basic question to be examined in this paper is as follows: What relationship if any exists between the growing trend toward utilization of the maintenance service contract, the need for expanded contract administration organization, and the degree of Public Works Officer satisfaction with maintenance service contractor performance at MCAS El Toro and at other Navy and Marine Corps activities?

#### STUDY HYPOTHESIS

The study hypothesis for this research project can be stated as follows: The growing trend toward utilization of the maintenance service contract is a fact at MCAS El Toro as well as a large number of other Navy and Marine Corps activities. The magnitude of this service contract volume is such that the absence of appropriate organizational resources to administer these contracts is resulting in maintenance service contractor performance that is marginal or unsatisfactory to the Base Maintenance or Public Works Officer.

#### DEFINITION OF TERMS

The terms defined below are provided to establish a basis for facilitating the communication of the basic ideas and findings of this paper.

##### Activities

For purposes of this paper the term Activities or Navy and Marine Corps activities is used synonymously with terms such as Naval Stations,

Naval Air Stations, Marine Corps Air Stations, Marine Corps Bases, and other similar terms. It refers to installations on which units of the Navy and Marine Corps locate their facilities and from which they conduct their operations.

Armed Services Procurement Regulations (ASPR)

That set of congressionally established regulations which guide and control all procurement of goods and services by the military elements with the Department of Defense.

Base Maintenance Officer (BMO)

That military officer, in most cases a Marine Corps officer, charged with facilities maintenance at a Marine Corps facility. This term is used interchangeably in this paper with the Public Works Officer (PWO).

Chief of Naval Operations (CNO)

The senior Naval officer on active duty and the Navy representative on the Joint Chiefs of Staff.

Commandant of the Marine Corps (CMC)

The senior Marine Corps officer on active duty and the Marine Corps representative on the Joint Chiefs of Staff.

Department of Defense (DOD)

That cabinet-level federal agency headed by the Secretary of Defense through which the President and the executive branch exercise control over the military establishment.

Maintenance Service Contract (MSC)

A type of contract defined by the Service Contract Act of 1965 under which the federal government may acquire certain services through the use of a contractor's time and effort. This term is used interchangeably herein with service contract.

Naval Facilities Engineering Command (NAVFAC)

That systems command within the organizational structure of the United States Navy which provides for the Navy and Marine Corps technical staff support for the acquisition and maintenance of facilities.

Officer in Charge of Construction (OICC)

That officer of the Navy's Civil Engineer Corps granted certain authority for awarding and administering construction and maintenance service contracts in support of acquisition, maintenance and repair of Navy and Marine Corps facilities.

Public Works Officer (PWO)

That officer of the Navy's Civil Engineer Corps assigned to a Naval or Marine Corps activity working for the activity commander with responsibilities to that commander for base facilities maintenance. In many cases, the PWO is also the OICC for that activity and as the OICC reports to the commander of the geographical engineering field division (EFD).

Service Level

That level of organization within the federal government which is headed by the Secretary of the Navy or Defense.

Western Division, Naval Facilities Engineering Command (WESTDIV)

That engineering field division which supports MCAS El Toro and other activities in the Western United States. The Western Division, Naval Facilities Engineering Command (WESTDIV) located in San Bruno, California, is one of six field divisions through which the Naval Facilities Engineering Command executes its responsibilities for facilities acquisition and maintenance.

## RESEARCH DESIGN

The main thrust of this research involved a tentative identification of those factors possibly having an impact on the performance of the maintenance service contractors at MCAS El Toro. It is readily apparent from the problem question and general hypothesis that it was judged that a significant contributor to the quality of contractor performance was the lack of a complete contract administration organization. To test the stated hypothesis a questionnaire was developed that embraced not only the general hypothesis dealing with the inadequate contract administration organizational structure, but also other factors considered to have potential impact on maintenance service contractor performance. These other factors such as the ASPR requirement to award to the low bidder, the quality of the contract document, service level involvement in policies and procedures for MSC administration, and the geographical location of the activity were identified by the ten different specific hypotheses.

The questionnaire was designed to compare the opinion of the PWO at El Toro with the opinion of the PWO's/BMO's at twenty other Navy and Marine Corps activities as it related to each of the stated hypotheses.

## SUMMARY

This paper was undertaken with the acknowledgment that service contractor performance at El Toro was of a quality less than desirable. It was the intent to study the problem through inquiries and cross fertilization with Public Works Officers at other Navy and Marine Corps activities utilizing the service contract. The study was planned to identify problem areas at El Toro and to conceive action that would hopefully bring solutions to these problem areas. Additionally, the intent was to determine the applicability of the proposed solutions and where appropriate make available these recommended solutions to other activities. It was fully expected that problem areas would be confirmed where local-level authority for change did not exist. In these cases the purpose of this study would be to recommend actions by those at the proper level of authority or recommend further study in those instances where well defined suggestions for corrective actions could not be made.

## Chapter 2

### LITERATURE REVIEW

The Maintenance Service Contract effort within DOD is one product of a public sector practice that is more widely known in the private sector as the make or buy decision-making process.

The make or buy decision in general refers to the choice between manufacturing a component of a product in the company's own plants or purchasing it from an outside supplier or suppliers.<sup>1</sup> The make or buy decision-making process is one particular aspect of managerial decision-making where the manager exercises flexibility and versatility in the pursuit of effective resource utilization.

Make or buy decision-making concepts have served managers of all types of organizations for probably as long as there have been organizations and managers to serve. These concepts, however, hold different meanings for different managers and different organizations; but in the main, they reduce to that of attempting to maximize the attainment of organizational objectives through the most effective utilization of limited organizational resources.

As goals and objectives vary from organization to organization, so do the factors influencing the make or buy decision. Whatever these varying factors may be, the use of this decision-making process is

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<sup>1</sup>Ernest Dale, Management: Theory and Practice (New York: McGraw-Hill Book Company, 1973), p. 776.

ubiquitous in both the public and private sectors. The range of products and services given make or buy consideration is for all practical purposes infinite. Accordingly, there are many individual treatises, particularly in the periodical literature, which describe the make or buy process and its significant subset, service contracting, as they are used by different companies and industries.

At Polaroid Corporation for example, a "make" decision for parts for the SX-70 camera was changed to a "buy" decision because making the parts in house was not consistent with the company's more-humanistic objective of providing meaningful and professionally fulfilling work for its employees. This company objective at Polaroid was commonly referred to as "The Second Aim."<sup>2</sup>

In another illustration, Special Libraries executed a buy decision and contracted for certain functions simply because it was a means of providing a required service in the most cost-effective way.<sup>3</sup>

These two examples are typical of what is held in the literature describing make or buy activity and they vividly illustrate the utilization of this process to more-effectively convert organizational assets or resources into the attainment of organizational objectives.

The maintenance service contract or service contract is brought into action as a direct result of a company or organization, public or private, exercising the make or buy decision-making processes and making the decision that contracting out for a particular product or service is the most-effective way to acquire that product or service relative to the attainment of organizational goals.

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<sup>2</sup>Gary D. Levey, "The Second Aim," Management Accounting, LV, 12 (June, 1974), 47.

<sup>3</sup>Herbert B. Landau, "Contract Services in the Special Library, The Make or Buy Decision," Special Libraries, LXIV, 4 (April, 1973), 175.

To assist and guide the managers through the make or buy decision-making process, each organization usually establishes varying degrees of policies and procedures governing executive action in this area. It is reasonable to generalize that the larger the organization, the higher the number of these guidelines and company procedures. If the strategy and structure are consistent, then these policy guidelines should likewise be consistent and lead to a decision enhancing the attainment of organizational goals.

Within the public sector and in particular the Department of Defense, the make or buy decision is utilized throughout the total spectrum of management. The availability of this process is again intended to allow managers at all levels the flexibility and versatility to optimize the conversion of resources to agency goals and objectives. Similarly, within the organizational structure of the federal government, just like private industry, policies, procedures, and guidelines have been established governing the make or buy decision-making process. Additionally, the Armed Services Procurement Regulations have been developed within DOD to guide the procurement of those goods or services once the decision has been made to buy from the private sector rather than provide the product or service utilizing in-house resources.

The decision, therefore, to utilize the maintenance service contract within DOD is arrived at following the policies referred to briefly in Chapter 1. Specifically, the major policy guidance comes from the OMB originated and promulgated policy of contracting out to the maximum extend possible.<sup>4</sup> The follow-on commercial and industrial review process establishes the procedures for executing the make or buy decision

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<sup>4</sup>"Commercial and Industrial Activities Overview," ALM 39-4013-LC(B), p. 1.

consistent with OMB policy to contract-out.<sup>5</sup> After the contract-out decisions are made, the ASPR's then take over, as guides and controlling directives for the procurement of these services as well as for the administration and enforcement of the contracts. Through this triad of policies, procedures, and directives, the federal government has gone full cycle in defining basic elements of policy and procedure in the selection of and the utilization of the maintenance service contract.

The statement was made in Chapter I that a Public Works Officer's use of the maintenance service contract is, in effect, an extension of his resources for base maintenance. Although these various contractors are not government employees in the same sense that civil servants are, the contractors are nevertheless providing a service for which that Public Works Officer is responsible. It follows that the same basic tenents that represent his management of in-house employees in the accomplishment of their tasks and functions should likewise be present in his management of the contractors providing those services for which he is responsible. Since the Public Works Officer manager retains the same responsibility for providing a service by contract as he has for providing it with in-house personnel, his authority to manage or control contract personnel should equal his authority and control of in-house employees. With his extension of resources via the maintenance service contract, he likewise requires an equivalent extension in span of control over these contractor forces. In all managerial functions, the Public Works Officer needs parity between in-house and contractor personnel. This is particularly true in the managerial functions of performance evaluation and control.

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<sup>5</sup>"Commercial and Industrial Activities Overview," p. 1.

A central issue of this study and this paper is whether or not the triad of federal government policy and procedures leading to and governing the maintenance service contract afford the Public Works Officer the same authority and capability to exercise primary managerial functions over service contractors as he has to manage his in-house employees. Of principle concern are the functions dealing with performance evaluation and control.

Many writers, scholars, and managers have articulated their views on what constitutes the primary functions of management.

Early formulation of managerial functions came out of the work of Henri Fayol in which he defined the management process as being composed of five essential functions:

1. Planning
2. Organizing
3. Command
4. Coordination
5. Control<sup>6</sup>

Subsequent to Fayol several other individuals have taken their turn at defining and describing the managerial functions as they saw them. In the early years, the late 1930's and the early 1940's, other writers essentially expanded on those ideas as published by Fayol.

Lyndall Urwick accepted those five functions as stated by Fayol but added a *forecasting* function, expanding Fayol's list from five to six.<sup>7</sup> R. C. Davis believed that the major managerial functions could be

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<sup>6</sup>General and Industrial Management (London: Sir Isaac Pitman and Sons, Ltd., 1949), p. 17.

<sup>7</sup>The Elements of Administration (New York: Harper and Row, Publishers, 1943), p. 27.

described as *planning, organizing, and controlling*.<sup>8</sup> He therefore condensed rather than expanded the functions defined by Fayol. In roughly the same period, Chester Barnard described the essential managerial function as:

1. *Providing a system of communication*
2. *Securing essential efforts*
3. *Formulation and defining purpose*<sup>9</sup>

In more recent times as writers in the field of business and management became more prolific, others inked their descriptions and definitions of essential managerial functions. Examination of this period of literature treating the principles of management reveals that there is still a great deal of consistency with the initial writings of Fayol. Certain areas have been expanded and some slightly reduced or eliminated but basically a list of recent writers and their identification of basic elements and principles of management are harmonious with those of Fayol.

Ernest Dale and L. C. Michelon stated that the functions of management are *planning, organizing, staffing, direction, control, innovation, representation, and communication*.<sup>10</sup> Harold Koontz and Chester O'Donnell defined the functions as *planning, organizing, staffing, directing, and controlling*.<sup>11</sup> R. A. Johnson, F. E. Kast, and J. E. Rosenzweig limited their principle elements to *planning, organizing,*

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<sup>8</sup>The Fundamentals of Top Management (New York: Harper and Row, Publishers, 1951), p. 154.

<sup>9</sup>The Functions of the Executive (Cambridge: Harvard University Press, 1938), p. 215.

<sup>10</sup>Modern Management Methods (Cleveland: The World Publishing Company, 1966), p. 2.

<sup>11</sup>Principles of Management: An Analysis of Managerial Functions (New York: McGraw-Hill Book Company, Inc., 1968), p. 95.

*control and communication.*<sup>12</sup> Joseph L. Massie chose to describe managerial functions as consisting of *decision making, organizing, staffing, planning, controlling, communicating, and directing.*<sup>13</sup>

Almost to the man, researchers include the function of control in their listings of basic managerial principles. It is toward this basic function of control and its applicability to the Public Works Officer and maintenance service contracting that this literature search was directed. Specifically, do the elements of control and performance appraisal afforded the Public Works Officer by current DOD directives allow him to execute his overall managerial responsibilities effectively; allow him to control contractor performance to the degree where he can influence and assure compliance with established standards of performance; and maintain a degree of parity with managers in private industry acquiring service via the maintenance contract?

#### CONTROL

Dale defines control as follows:

... he (the manager) determines how well the jobs have been done and what progress is being made toward the goals. He must know what is happening so that he can step in and make changes if the organization is deviating from the path he has set for it.<sup>14</sup>

Another more generalized description of control has been put forth by Anthony P. Raia in which he says that

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<sup>12</sup>The Theory and Management of Systems (New York: McGraw-Hill Book Company, Inc., 1967), p. 14.

<sup>13</sup>Essentials of Management (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1964), p. 6.

<sup>14</sup>p. 5,

... The exercise of *control* is the crucial connecting link between putting plans into action and the attainment of desired results. Managerial control involves measuring progress and performance and, when necessary, taking corrective action to assure that the objectives are being achieved. This generally requires sound data and appropriate feedback mechanisms (i.e., an effective information system).<sup>15</sup>

No lesser figure than Peter Drucker offers yet another description that, *inter alia*, makes a distinction between *control* and *controls*:

In the dictionary of social institutions, the word "controls" is not the plural of the word "control." Not only do more controls not necessarily give more control, the two words, in the context of social institutions, have different meanings altogether. The synonyms for controls are measurement and information. The synonym for control is direction. Controls pertain to means; control to an end. Controls deals with facts, that is, with events of the past; control deals with expectations, that is, with the future. Controls are analytical, concerned with what was and is. Control is normative and concerned with what ought to be.<sup>16</sup>

Drucker additionally sets down the characteristics of controls and states that they *can be neither objective nor neutral; need to focus on results; and are needed for measurable and non-measurable events.* Further, he says that for the manager to control, controls must satisfy seven specifications: *economical, meaningful, appropriate, congruent, timely, simple, and operational.*<sup>17</sup>

Based on the foregoing, it seems that it is reasonable to state that an organization without an effective system of controls is an organization without effective managerial control. The manager, the

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<sup>15</sup>Managing by Objectives (Glenview, Ill.: Scott, Foresman and Company, 1974), p. 82.

<sup>16</sup>Management: Tasks, Responsibilities and Practices (New York: Harper and Row, Publishers, 1974), p. 474.

<sup>17</sup>p. 496.

decision-maker, the executor of policy, must know whether or not organizational efforts are producing the desired results relative to company goals. If in fact they are not, he must be equipped with the necessary influence, power, or control to alter that effort toward more-effective goal attainment. His ability to do this as well as his organizational license to control are a direct measure of his managerial effectiveness and indeed a primary indicator of the future success or failure of his organization. Control means control of all resources convertible to organizational objectives. Where an organization utilizes contractors to provide goods and services as opposed to providing these same services by in-house employees, that manager must be able to effect the same degree of influence on results modification with the contractor as he does with his own employees. He must, in fact, have an equal system of controls and an equal amount of control.

#### CONTROL AND SERVICE CONTRACTING

There is a sizable quantity of material within current periodical literature which deals with the idea of make or buy as it relates to facilities and equipment maintenance management. A principal area of maintenance service contracting found in the literature is that which deals with contract maintenance for large industrial buildings and factories, and for the large items of machinery housed within these buildings and factories.

Many companies in many industries rely on the maintenance service contract to extend their resources and to improve the overall effectiveness in achieving organizational goals. In most cases, these many companies and industries arrive at the use of the maintenance service

contract via some local version of the make or buy decision-making process. Several spokesmen for these companies and industries have articulated, primarily through the periodical literature, their company's attitudes, policies, and results realized with the use of the make or buy decision-making process and the resulting service contracts.

G. D. Levey, at one time the senior manufacturing manager at Polaroid, believes that an activity must satisfy eight basic conditions for successful manufacturing:

1. Products must be manufactured in accordance with drawings and specifications as provided by product design
2. Products must be produced at the lowest possible cost consistent with meeting the specifications mentioned above
3. The capital investment required to achieve the stated objective must be minimized
4. Delivery times must be met whether they be delivery of finished products to customers or distribution centers or whether they be the delivery of parts and components to the company or to its suppliers
5. A good working environment must exist
6. The ability to be flexible with respect to new product introduction and changes in existing products must be retained
7. Process improvements must be rapidly implemented to impact on product cost and quality
8. The last condition for successful manufacturing is feedback to product design and marketing

Levey maintains that these eight conditions must exist whether one is doing all of his product manufacturing in-house or whether he is heavily involved in buying components, assemblies, or products from others.<sup>18</sup> These conditions as stated by Levey, no doubt, serve as guidelines at Polaroid for not only the make or buy decision, but also for the selection of a contractor once a buy decision has been reached.

There are reasons other than purely efficient resource utilization which lead companies to contract-out for products or services rather than do them in-house. In the previously mentioned area of the servicing of sophisticated plant equipment, one writer cites a short supply of experienced maintenance personnel capable of providing this function in-house as the principal reason for going to contract. The contract is a single contract for the maintenance of a complete industrial facility. In return for a fee, the single contractor provides the necessary supervision, manpower (craftsmen such as electricians, pipefitters), tools, and equipment.

In general, this writer sees a particular need, other than improvement of resource conversion being satisfied by the utilization of the maintenance service contract. Not only does the service contract overcome a particular maintenance skill deficiency, while doing so it also offers certain advantages over doing the same service in-house:

1. Reduced capital expenditures. Major and minor construction equipment and tools can be provided by a contractor on a rental basis.
2. Minimum down-time. A maintenance contractor can often supply extra men for a particular job on an around-the-clock basis if necessary.

3. Flexibility in maintenance scheduling. Under contract maintenance, the operating department can shut down at any given time because planning and scheduling will determine the number and kinds of craftsmen needed each day for a particular operation.
4. Qualified labor supply. Contract maintenance provides for the selection of qualified craftsmen in each classification; it tailors the manpower to the workload of the particular plant.

In addition to the advantages cited above, the writer also points out potential pitfalls in the use of the maintenance service contract. Similar to the eight conditions for successful manufacturing utilized at Polaroid, F. P. Flesca, of Catalytic, Inc., suggests five factors to assure the success of a maintenance service contracting program:

1. Select a reliable contractor and make sure his experience and record of performance measure up to the job.
2. Consider the scope of services offered by the contractor. Do they include a complete range of technical services?
3. Give special attention to the relationship between the contractor and labor and vice versa; a contractor's association with labor is the crux of contract maintenance.
4. Put a priority on performance. If the contractor does not perform satisfactorily, the contract should permit cancellation of services without obligation on the customer's part.
5. Define working relationships. The entire maintenance program should be worked out jointly to define the areas

of responsibility for the maintenance contractor and plant staff to provide adequate but minimum personnel to do the job.<sup>19</sup>

In addition to the advantages and potential pitfalls cited above, Flesca also addresses the managerial function of control and submits that the most significant advantage realized throughout the entire process is the control retained by the plant engineer for achieving program objectives and their associated costs. Other than the five factors he cited, he does not elaborate on the intricacies and procedures or *controls* utilized in achieving the *control*.

In the 1960's and early 1970's, RCA's service division operated and maintained under contract all facilities and equipment associated with the Fylingdales radar station in Yorkshire, England. In the years that RCA had the contract, its service personnel at Fylingdales were responsible for the proper operation of everything from laboratories to main radar transmitters. In the process, they gained experience in the maintenance of a wide range of facilities, equipment, and systems and demonstrated convincingly that their systems approach to maintenance management resulted in better quality maintenance as well as a considerable manpower reduction.

This systems approach to maintenance management could be reasonably well-described as part of or similar to the term *terotechnology*. Terotechnology was first coined as a term by Peter Jost. He defines it as the technology of installation, commissioning, maintenance, replacement and removal of plant, machinery, and equipment,

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<sup>19</sup>"Beating the Personnel Squeeze with Contract Maintenance," Management Review, LX, 5 (May, 1971), 43.

of feedback to operation and design, and of related subjects and applications.<sup>20</sup> In England and Europe in the early seventies, it was felt that the creation of this term was instrumental in focusing attention on the vital subject of maintenance management.

Following the experience at Fylingdales, RCA sought to apply this same systems approach of multi-disciplinary maintenance engineering to other industries. The RCA technique is to totally evaluate a company's maintenance needs, to apply the terotechnological concepts to this evaluation, and then define and set up a maintenance program consistent with the company's ultimate goal of profitability. It holds that they are qualified to carry out both technological and financial surveys and then set up a system that best suits the needs and desires of the customer. After the system is set up, RCA can either train the customers staff to take over the maintenance functions or remain under contract for the continuing execution of that plan. It is in fact offering, under contract, the full spectrum of maintenance management services. RCA takes it from the information required for the make or buy decision to the actual performance of maintenance services under contract. RCA has certainly proven the reality of success using the systems or terotechnological techniques.

Additionally, in England, the Department of Trade and Industry, circa 1970, had a committee on terotechnology which, as of mid-1972, had produced some convincing figures. A working party of that committee showed that total direct costs of engineering maintenance in the British manufacturing industry are about £1100 million a year. Inadequate

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<sup>20</sup>David Millichamp, "Terotechnology - the Package Deal Which Cuts Losses," The Engineer, CCXXXIII, 6027 (9 September, 1971), 50.

maintenance affecting production costs about £200 to £300 million a year, and this could be saved. Maintenance staff productivity could be raised by 60 percent which would provide savings of £200 to £300 million a year.<sup>21</sup>

The details of the managerial functions associated with terotechnology concepts in England and Europe are not specifically addressed in the referenced literature but the bottom-line effectiveness of maintenance by contract is certainly documented.

Areas other than purely manufacturing, processing, or facilities have likewise reported in the literature experiences with the make or buy concepts and service contracting. H. H. Landau chronicled the use of contract services within the Special Library. Like other industries and other fields, the librarian cogitating over the question of performing a needed service with his own resources or purchasing the service from an outside supplier, is facing the classic make or buy management decision. Landau offers that should the librarian decide to go for the contract services, he must be able to support his decision on the basis of four important management parameters: 1. *cost*, 2. *availability of resources*, 3. *convenience*, and 4. *quality and objectivity of results*.<sup>22</sup> Additionally, Landau emphasizes the need for detail and attention in the preparation of the work statement and proposal and allows that in many cases incidents termed contractor "failures" were actually the result of a client not satisfactorily defining his requirements. As he gives emphasis to the work statement

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<sup>21</sup>Keith Dale, "Plan Out Maintenance and Save with the New Terotechnology," The Engineer, CCXXXIV, 6061 (11 May, 1972), 53.

<sup>22</sup>p. 177.

and proposal, the writer likewise provides guidance for principal features that should be part of the service contract document itself. He says the contract should specify the following mutually agreed-upon points: 1. specific work to be performed with clarifications on what is not to be performed; 2. work sequence to be followed; 3. the timetable for the work, giving start and completion, showing all phases and indicating whether the times are fixed or variable depending on the work volume; 4. final products or services to be delivered to the client as a result of this effort; 5. interim reports and products, if required; 6. statement of what will be paid to the contractor for work performed, payment schedules, cost breakdowns to be provided to the client, and any cost constraints such as cost ceilings on certain costs or non-allowable expenses; 7. specifications of who will represent the contractor and who will represent the client in receiving or giving technical direction; 8. agreed-upon acceptance criteria for the final product.<sup>23</sup> Landau further states that judicious use of the service contract can yield such benefits as cost savings, convenience, and improved quality. He does not elaborate on the aspects of contract administration and the managerial control once the contractor has been chosen. He does, however, infer that the library service industry may well benefit from a more intensive analysis of contracted services and that this analysis should result in a handbook guiding the acquisition of library services by contract.

In practically all of the cases described above, regardless of industry or field of endeavor, most of the analyses and evaluations of service contracting and maintenance service contracting report out

favorably. In general it appears that most users of the service contract in the private sector over the past few years have principally viewed it as an effective method of extending organizational resources. Although the details of each industry or company and its associated policies and procedures for handling the service contract are not treated in abundance, the overall tone would indicate that the private sector is essentially accomplishing the extension of control over the service contractors attendant to the extension of resources.

Business policies provide control guides for decision making. They insure a minimum level of consistency and uniformity in making decisions affecting basic or strategic company practices. They are specifically applied to business problems that recur frequently and under similar but not identical circumstances.

Policies provide control limits and guides that insure the optimum achievement of the range and hierarchy of company objectives. They provide for the implementation and preservation of long-range strategies of the company.<sup>24</sup>

Contracting for services, facilities maintenance, or otherwise covers a myriad of types of services and a wide range of skills and skill levels. The application of the make or buy principles leading to the selection of a service contractor and the extension of company policies and managerial control for the administration of these contracts are essentially the same regardless of industry, type of service, skill, or skill level required.

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<sup>24</sup>William T. Greenwood, Business Policy, A Management Audit Approach (New York: The MacMillan Company, 1967), p. 205.

Although the literature warns of potential problem areas and pitfalls, it seems that the private sector has basically been able to solve the problem involving span of control and performance evaluation, at least in the instances documented in the literature. It follows that the private sector, in the main, has successfully modified and integrated company policies and procedures into managerial authority to the point where utilization of the service contract is indeed an extension of resources, of controllable resources afforded to the point of contact manager charged with and in the pursuit of more effective attainment of company objectives.

#### SERVICE CONTRACTING WITHIN THE FEDERAL GOVERNMENT

It was stated earlier that within the framework of the federal government, and specifically the Department of Defense, certain policies and procedures have been formulated which govern managerial action in the utilization of the maintenance service contract. This triad as it was termed earlier, consists of 1. a basic federal government policy promulgated by OMB which states that the federal government will contract out to the maximum extent possible for those products and services it requires; 2. a commercial and industrial review process whereby government agencies periodically review and compare the method by which they are acquiring needed products or services and then select (make or buy) that method most closely conforming to pre-established criteria, and 3. a set of procurement directives known as the Armed Services Procurement Regulations or ASPR's, which govern the acquisition of a product or service by contract once the contracting method has been selected.

With this triad, the federal government has let its policy be known, has published ways and means of implementing that policy, and has established through the ASPR's a system of controls relative to procurement of goods and services by contract.

The hypothesis for this study indicates an increasing need to utilize the service contract for routine base maintenance functions. The research contained herein explores the adequacy and relevance of this triad as it relates to the effectiveness of control provided to the Base Maintenance or Public Works Officer in the utilization of this method of service procurement. It, in fact, examines, through the opinions of numerous Public Works Officers, whether or not this labyrinth of policies and regulations provides the necessary tools and controls to effectively control.

Within the federal government, the magnitude of work being done in-house but which must be examined periodically by the commercial-industrial review is enormous. At stake in this periodical evaluation for contracting-out are a million civil service jobs and literally billions of dollars of federal contracts--most of them with DOD.<sup>25</sup> Consequently, "contracting-out," a normally innocuous term, has become to labor unions and defense contractors the watchword in a bitter battle being waged in Congress, the Pentagon, and the courts.<sup>26</sup> The quantity of jobs and dollars involved here is such that even a small percentage shift either way (government to free enterprise or vice versa) might appear to have a significant impact on the other and has created a

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<sup>25</sup>The Bureau of National Affairs, Special Report ALM 37-4013-H, (April, 1974), 1.

<sup>26</sup>Lloyd K. Moseman, II, "Contracting Services: Too Many or Too Few?" Government Executive, VIII, 1 (January, 1976), 30.

classic conflict between the government and free enterprise in the handling of services, including facilities maintenance contracting.

Each side of this conflict, in the process of struggling to keep its piece of the action or gain more, constantly engages in actions and rhetoric to sell its side of the argument. Each side is articulate, knowledgeable, and powerful, from the labor union halls to Congress and from the lowest paid civil service employee to the highest levels of the executive agencies of the federal government.

Each side offers advantages and disadvantages in the accomplishment of the myriad service functions required by the federal government. It is around these advantages and disadvantages that much periodical literature is written. It is around this great debate and conflict between the government and free enterprise that the policies, procedures, and directives of the triad are implemented. Because of this great debate, the implementation of the triad transcends pure business and management logic and is tempered with political overtones ringing from some of the most powerful elements within America's structure of government. Analysis of this triad with respect to the extension of managerial control must likewise consider the politically tempered nature of the government system.

There has been a sizable amount of opinion expressed in the literature regarding the effectiveness of the triad in the utilization of the service contract. In a good many cases, it can be said that the thrust of each article or paper is largely dependent on which side of the political debate the writer resides. If an article is written by a person who is pro-government union, no doubt he will expound on the virtues of in-house accomplishment. If, on the other hand, the

writer is sympathetic to unions or industries within the private sector, he will, in all probability, extol the cost benefits resulting from competition for the contract in the private sector.

In some instances, the triad and its effectiveness has been studied and, in some cases, challenged within DOD.

F. W. Helwig, K. D. Newlin, and M. G. Norton analyze the make or buy decision criteria for commercial and industrial types of activities within the DOD. In this analysis, they speak to the political controversy surrounding the government's implementation of its contract-out policy and how the sociological and political considerations indeed complicate the make or buy process for government decision makers.<sup>27</sup>

More directly related to military bases and stations, Dale K. Randels examined the in-house or contract-out question for real property maintenance activities. In his research, he examined the in-house or contract idea by considering and examining such factors as relative costs and the difficulty associated with accurately estimating and determining what these costs are, contractor performance, labor and contractor availability and continuity, supplies and equipment for the contract, changeover turbulence, type and methods of contracting, impact of special government policies and programs (personnel ceilings, bias toward private industry, small business set-asides), risk of strikes or other labor unrest, and relative flexibility.<sup>28</sup>

The factors examined above were essentially an identification of pitfalls and troublesome areas faced by the local level contracting

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<sup>27</sup>"Analysis of the Make-or-Buy Decision Criteria for Commercial/Industrial-Type Activities," Army Procurement Research Office, Fort Lee, Virginia, 1976, 95.

<sup>28</sup>"Real Property Maintenance Activities--In-House or Contract," Army War College, Carlisle Barracks, Pa., 1975, 86.

officer or Base Maintenance Officer as seen by Randels. His study of these factors was, in effect, an examination of the triad and its effectiveness in affording the manager the best opportunity to optimize his resource conversion process.

This paper, in a similar fashion, identified certain factors believed to be trouble spots in the utilization of the maintenance service contract for routine base maintenance. These factors, enumerated in Chapter 3, were considered to be most likely to have the biggest contribution to the service contracting dilemma at Marine Corps Air Station El Toro, California. As stated by the general hypothesis for the paper, these factors essentially dealt with a growing utilization of the service contract and an examination of the effectiveness or ineffectiveness of current DOD controls to allow for satisfactory control of service contractors. These factors were incorporated into eleven specific hypotheses and examined through the solicitation of Public Works Officers' opinions at twenty other Navy and Marine Corps bases.

## Chapter 3

### RESEARCH METHODOLOGY

A growing need to rely on the maintenance service contract for base maintenance at MCAS El Toro and a concomitant dissatisfaction with the quality and quantity of work provided by these service contracts led to the formulation of the general hypothesis of this paper, restated below:

The growing trend toward utilization of the maintenance service contract is a fact at MCAS El Toro as well as at a large number of other Navy-Marine Corps activities. The magnitude is such that the absence of appropriate organizational resources to administer these contracts is resulting in maintenance service contractor performance that is marginal or unsatisfactory to the Base Maintenance or Public Works Officer.

Faced with the situation of having to use the service contract, and at the same time being basically dissatisfied with it, prompts a very logical question involving what is really wrong and what can be done to improve the situation. In the process of analyzing why the contractors at El Toro were not delivering satisfactory service, several factors were identified as being potentially influential in the quality and quantity of work received. These factors are generally described below:

1. Assurance of adequate organizational elements to inspect and certify the service contractor's work.
2. Observation of the DOD requirement to award the contract to the lowest conforming bidder.
3. Recognition that metropolitan areas have high population densities and therefore produce a large quantity of interested contractors or available bidders.
4. Assurance of quality of the contract document prepared by the government.
5. Control of service-level interest and action to formulate procedures in direct support of the administration of the maintenance service contract.

A basic objective of this research was to explore these factors and determine, where possible, what real relationship they may have with the quantity and quality of service contractor work received. In addition to the general hypothesis, eleven specific hypotheses were formulated which identify with utilization of the service contract, Public Works Officer satisfaction with contractor performance, and the impact on contractor performance realized by the five factors stated earlier.

Because the literature did not provide an abundance of "cook-book" solutions specifically related to the problems as they were identified and hypothesized at El Toro, it was determined that the most realistic exploration in this research would be accomplished using the descriptive survey method.<sup>1</sup> The task would be to seek the

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<sup>1</sup> Julian L. Simon, Basic Research Methods in Social Science (New York: Random House, 1969), p. 244.

opinions and ideas of other Public Works and Base Maintenance Officers who, like the PWO at MCAS El Toro, utilized the maintenance service contract to accomplish routine recurring base maintenance. Specifically it would seek to determine whether or not the factors of utilization, PWO satisfaction, and factors influencing satisfaction at other activities were similar to those at El Toro. Such a method of research provided not only a range of applicability for proposed improvement actions incident to this research, but also identified activities and PWO's who perhaps had already solved problems which were at the time unsolved and unresolved at MCAS El Toro.

To pursue this PWO survey technique, an eighteen-item questionnaire was developed. This questionnaire included items designed to test all hypotheses. Additionally, it was designed to provide for the collection of actual historical data describing maintenance service contracting efforts at each of the responding activities. It was configured in such a way as to allow for comparison of PWO opinions.

Items 1 through 5 of the questionnaire provide raw data on the size of the activity, the population size of the metropolitan area where the activity is located, the size of the activity's Base Maintenance or Public Works organization (personnel and dollars), and a recent five-year history of statistics on service contract utilization. These first five questions therefore contained information extracted from the activity's records and served as a basis for documenting and quantifying certain facilities maintenance indices unique to each of the responding activities. Items 6 through 18, on the other hand, were organized and stated in such a manner as to elicit Public Works Officer

opinion in each of these thirteen questions. These items identified with one or more of the hypotheses and with the associated factors of potential influence.

It is reasonable to expect that a questionnaire developed in such a way as that described above should provide data which would allow for a statistical evaluation of each of the hypotheses. This statistical evaluation would then serve as a basis for acceptance or rejection of each of the hypotheses. Additionally, this questionnaire provides a data base from which a collective Public Works Officer opinion could be established on any of the factors represented by items 6 through 8. Data of this type allow the analyst to make some judgment on how much similarity exists between the collective Public Works Officer opinion and the opinion of the PWO at MCAS El Toro on these influencing factors and therefore allows the analyst to reach some conclusion related to the range of applicability of each factor. The methodology and strategy for data collecting and data usage were thus established. The responses to each of the items are shown in Appendix B. The questionnaire utilized in collecting these data is included in Appendix A.

#### RESPONDENTS

In the data-collecting part of the research, the questionnaire was distributed to the Public Works or Base Maintenance Officers at over 25 Navy and Marine Corps bases in the United States and Canal Zone. Twenty-one completed questionnaires, including the one from MCAS El Toro, were returned to serve as input data for this paper.

All responding officers were officers in the Navy's Civil Engineer Corps even though some of these officers were assigned to Marine Corps activities. In all cases the responding activity used the

maintenance service contract to accomplish a portion of its recurring base maintenance.

In most cases, particularly among the Naval stations surveyed, the PWO's and their Public Works Departments are organizationally similar and fit into the command structure of the activity in a similar fashion as their counterpart department at other Naval installations. Therefore, at the Naval activities the Public Works Officer is charged with the overall facilities maintenance program and in most cases serves additionally as a Naval Facilities Engineering Command (NAVFAC) assigned officer in charge of construction for the administration of construction and maintenance service contracts. In this situation the PWO plays a dual role, one for base maintenance and one for contract administration. The role of the PWO at some Marine Corps activities (mostly air stations) is essentially the same as it is at the Naval activities; that is, PWO and OICC. Such is the case at Marine Corps Air Station El Toro.

Some of the responding activities, particularly Marine Corps activities other than air stations, are at present configured organizationally in a slightly different way. The basic difference is that the Civil Engineer Corps Public Works Officer serves essentially as the OICC or contract administrator and is not directly charged with the responsibility for total facilities maintenance, although his tasks support this activity also. This overall base maintenance function at activities so configured is normally handled by the Base Maintenance Officer which is, in most cases, a Marine colonel. It is accurate to state, therefore, that all respondents were Navy Civil Engineer Corps officers with similar functions related to the maintenance service contract. In most cases they were involved in the dual role of facilities maintenance and

contract administration and in some cases only contract administration. However, whether directly responsible for base maintenance or not, all had similar visibility and proximity to their activity's effort with maintenance service contracting.

The responding activities were situated in various locations throughout the United States and one was in the Canal Zone. Efforts were made to choose responding activities so as to get a wide geographical cross section as well as a wide cross section related to population density in the immediate vicinity of the activity.

#### DATA ANALYSIS

The tabulated responses to each item of the questionnaire are shown by individual items in Appendix B. The methods of statistical analyses of the data varied, depending on the hypothesis the item was testing.

Hypotheses 1 through 3 were stated claiming certain correlations. The first two sought to show the growing trend in the utilization of the maintenance service contract over the past five years. The testing of these two hypotheses then attempted to show some correlation between the time since 1971 and the increased utilization. Hypothesis 3 sought correlation between contractor performance and size of the metropolitan area where the activity was located.

In each situation where the hypothesis involved a correlation (one - three), the Pearson product-moment method was utilized to determine the correlation coefficient  $r$ .<sup>2</sup> A special formula was associated

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<sup>2</sup>G. Milton Smith, A Simplified Guide to Statistics for Psychology and Education (New York: Holt, Rinehart and Winston, Inc., 1970), p. 157.

with this method which allowed for a utilization of the  $t$  test to test the significance of  $r$ .<sup>3</sup> In effect this procedure tests the null hypothesis that the sample of pairs of scores (years and number of MSC's in Hypothesis 1; years and dollar volume in Hypothesis 2; and area population and PWO judgment in Hypothesis 3) are drawn at random (by chance) from a larger population in which the correlation between the pairs of scores or variables is zero. By using the associated computed value of  $t$  it is possible to perform a  $t$  test on this null hypothesis. In other words, if the appropriate  $t$  tables indicate that the calculated value of  $t$  is very improbable on the basis of this hypothesis, the null hypothesis would be rejected and the conclusion reached that something other than chance was responsible for the obtained value of  $r$ . In such a case it is concluded that  $r$  is significantly different from zero (at whatever probability level the tables indicate) and that there really is some relation between the pairs of scores.

For hypotheses 1 through 3 the correlated data were analyzed based on the methods and computational techniques described above. More details on the individual values and sample calculations are included in Chapter 4 and Appendix C.

Hypotheses 4 through 11 were analyzed and evaluated using a somewhat different approach than the one used for the first three hypotheses. It is readily apparent from the preparatory phrase associated with each of these eight hypotheses that the major thrust in the analysis deals with making some determination of agreement or disagreement between the attitude of the Public Works Officer at MCAS El Toro and the attitude of the other PWO's as it relates to the several factors potentially influencing maintenance service contractor performance. The

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<sup>3</sup>Smith, p. 75.

analysis of the responses to each item, therefore, was built around identifying this agreement or disagreement of attitude. The technique used to identify this agreement or disagreement was one which compared the response score of the PWO at MCAS El Toro to the mean response score of the other twenty PWO's responding to the same item.

The comparison was made using a  $t$  test technique similar to that utilized in testing the significance of the computed value of the correlation coefficient  $r$  in hypotheses 1, 2, and 3.

Specifically, the  $t$  testing procedure was used to test the null hypothesis that "there is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and PWO's at other activities with respect to . . . ." By setting up the null hypothesis in each case in accordance with this preparatory phrase, it is assumed that the two samples (the PWO MCAS El Toro score and the mean scores of the other twenty PWO's) came from the same population; or it is assumed that there is no difference between the true means of the larger populations from which the sample sets are drawn. On the basis of computed  $t$  values and obtained probability values, certain conclusions can be reached about the reasonableness of the null hypothesis. If  $p$  is very small, the null hypothesis is rejected as improbable and the obtained difference between the two sample means is regarded as significant (that is, the hypothesis that the samples came from the same population is rejected and it is considered probable that the two sample means represent two different populations). If however,  $p$  is larger, little doubt is cast on the hypothesis and the obtained difference between the two means cannot be considered significant (that is, a small value of  $t$  could well have occurred from chance variation in the sample means drawn from the same population as the hypothesis assumed).

It was on the basis of this type of analysis using a probability criterion of  $p = 0.05$  that the agreement or disagreement of PWO opinion was determined; accordingly, for each specific hypothesis, 4 through 11. Specifics of the mathematical relationships used in the calculations which led to values of  $t$  for table entry are shown in part in Chapter 4 and in appendixes C and E as well.

From the acceptance or rejection of each of the hypotheses, certain determinations were made and certain conclusions were drawn about the various previously identified factors of influence or variables and their impact on the performance of the many maintenance service contractors. In addition to the conclusion reached purely on the basis of the  $t$  test and acceptance or rejection of the given hypothesis, certain conclusions were reached simply by subjective observation of the input data scores of each item. Conclusions reached on this basis did not have a pre-established parameter or criterion on which to make some arbitrary statistical comparison. Rather the opinions reached were more of the nature of "that suggested" by the data themselves and not something that was foreseen and predicted prior to the survey. Failure to treat and evaluate this suggested information would represent less than full utilization of the data collected. Conclusions reached in such a manner appear as comments in the "Summary of Hypothesis Analysis" section of Chapter 4.

## Chapter 4

### DATA ANALYSIS

Chapter 3 described the basic methodology used to conduct this research. Several factors were identified as possibly having some influence or impact on the quantity and quality of work performed by the various maintenance service contractors. From these factors one general hypothesis and eleven specific hypotheses were generated. In order to test these hypotheses the questionnaire, also described in Chapter 3, was constructed. This questionnaire, containing eighteen items, was completed by 21 Public Works Officers at various Navy and Marine Corps activities within the United States and the Canal Zone.

Some of the items contained data which were applicable to more than one of the specific hypotheses; and conversely, some of the hypotheses were evaluated using the responses to more than one of the items.

In this chapter each specific hypothesis is analyzed separately utilizing one or more items associated with it. From the analysis of each specific hypothesis, conclusions are drawn. With each hypothesis an attempt was made to do two things:

1. Determine whether there was an apparent collective opinion or attitude among the PWO's relative to the issue raised by the particular question or hypothesis.

2. Determine whether there was a significant difference of opinion between the PWO at El Toro and the other PWO's.

In addition to attempting to achieve these two things, some conclusions were drawn (see the general hypothesis RHPG) that were not conclusions

based purely on the statistical acceptance or rejection of the stated hypothesis. The attitude was that if the data were suggesting or indicating something, the suggestion was not ignored simply because it was not a reject or accept response. Accordingly, the following pages of this chapter analyze each hypothesis individually and state at the end of the individual analysis the conclusions reached relative to the given hypothesis and its associated questions.

#### RESEARCH HYPOTHESIS I ANALYSIS

RHP I There is a significant correlation between the number of maintenance service contracts and the number of years since 1971.

Null  $H_0$  There is no significant correlation between the number of maintenance service contracts and the number of years since 1971.

This hypothesis is tested utilizing item 4:

Item 4 - If the answer to item 3 is yes, list the number and dollar volume of your activity's maintenance service contract effort over the last five years as follows:

FY	<u>NO. OF MSC'S</u>	<u>TOTAL DOLLAR VOLUME</u>
1976	244	-
1975	178	-
1974	135	-
1973	67	-
1972	63	-

Utilizing the Pearson product-moment method, the correlation coefficient  $r$  was computed and found to have a value of 0.98. See Appendix C for sample calculation.<sup>1</sup>

In conjunction with the computation of  $r$  a special formula for  $t$  was utilized to test the significance of  $r$ . This value of  $t$  was calculated by using the formula

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

where  $n$  represents the number of pairs of scores which in this case was 5.  $t$  calculated in this manner was 8.5. Referring to the  $t$  tables (see Appendix D), with a degree of freedom of 3 ( $d.f. = n - 2$ ) the calculated  $t$  falls between the values corresponding to  $p = 0.01$  and  $p = 0.002$ .

Analysis based on item 4:

Using the above Pearson product-moment method, the Null Hypothesis  $H_0$  was tested. This test was that the pairs of scores were drawn at random from a larger population in which the correlation between the pairs of scores was zero. With the calculated value of  $r$  significantly different from zero and the  $p$  level at approximately .002, the indication is that there really is some relation between the number of maintenance service contracts and the number of years since 1971.

Conclusion based on item 4:

Reject the null hypothesis and conclude that there is a significant correlation between the number of maintenance service contracts and the number of years since 1971.

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<sup>1</sup>Smith, p. 157.

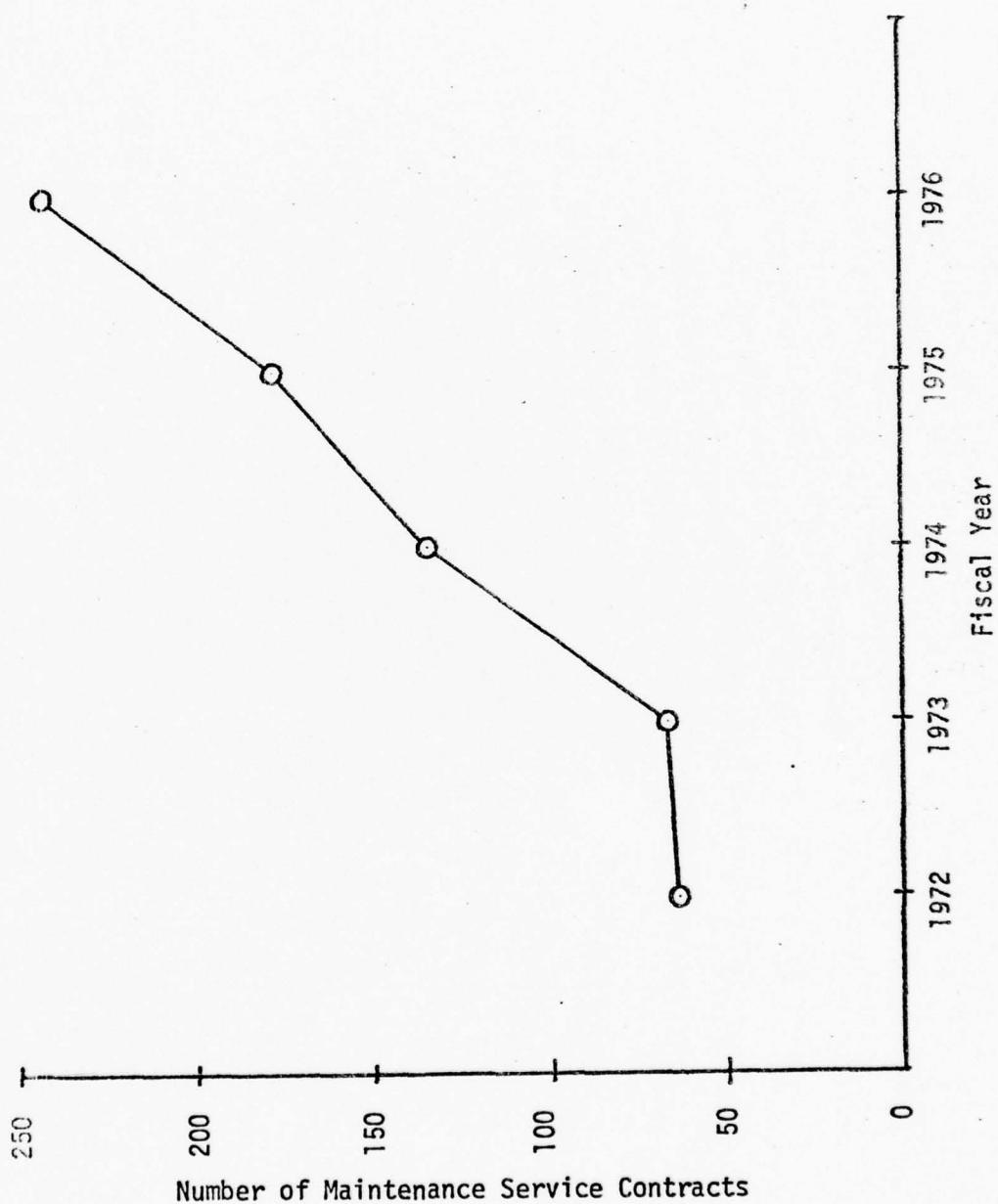


Figure 2  
Variation of Number of MSC and Period  
FY 1972 - FY 1976

Overall Conclusion RHP I:

There is a significant correlation between the number of maintenance service contracts and the number of years since 1971.

RESEARCH HYPOTHESIS II ANALYSIS

RHP II There is a significant correlation between the dollar value of maintenance service contracts and the number of years since 1971.

Null  $H_0$  There is no significant correlation between the dollar value of maintenance service contracts and the number of years since 1971.

This hypothesis is tested utilizing item 4.

Item 4 - If the response to item 3 is yes, list the number and dollar value of your activity's maintenance service contract effort over the last five years as follows:

<u>FY</u>	<u>NO. OF MSC's</u>	<u>TOTAL DOLLAR VOLUME</u>
1976	-	\$11,904,200
1975	-	9,516,500
1974	-	6,619,000*
1973	-	3,473,200*
1972	-	2,982,200*

\*These totals are slightly less than actual because two activities did not have complete files for these three fiscal years.

Utilizing the Pearson product-moment method the same as with Hypothesis I, the correlation coefficient  $r$  was computed. The computed value of  $r$  was 0.98. See Appendix C for the sample calculation of  $r$ . As with Hypothesis I, the statistic  $t$  was computed using the special formula

$$t = \frac{r \sqrt{n - 2}}{\sqrt{1 - r^2}}$$

with  $n = 5$ . The calculated  $t$  was again 8.5.

Analysis based on item 4:

The numbers from the data in item 4 reduced to the same value of the calculated correlation coefficient  $r$  and the associated calculated  $t$  value. Accordingly, the statistical analysis of item 4 as it relates to Hypothesis II is precisely the same as for Hypothesis I; that is, it is highly improbable that the null hypothesis is valid or that the statistics indicate that there is really some relation between the total dollar volume of maintenance service contracts and the number of years since 1971.

Conclusion based on item 4:

Reject the null hypothesis and conclude that there is a significant correlation between the total dollar volume of maintenance service contracts and the number of years since 1971.

Overall Conclusion RHP II:

There is a significant correlation between the dollar volume of maintenance service contracts and the number of years since 1971.

### RESEARCH HYPOTHESIS III ANALYSIS

RHP III There is a significant correlation between the size of the area where the activity is located and the number of poorly performing maintenance service contractors.

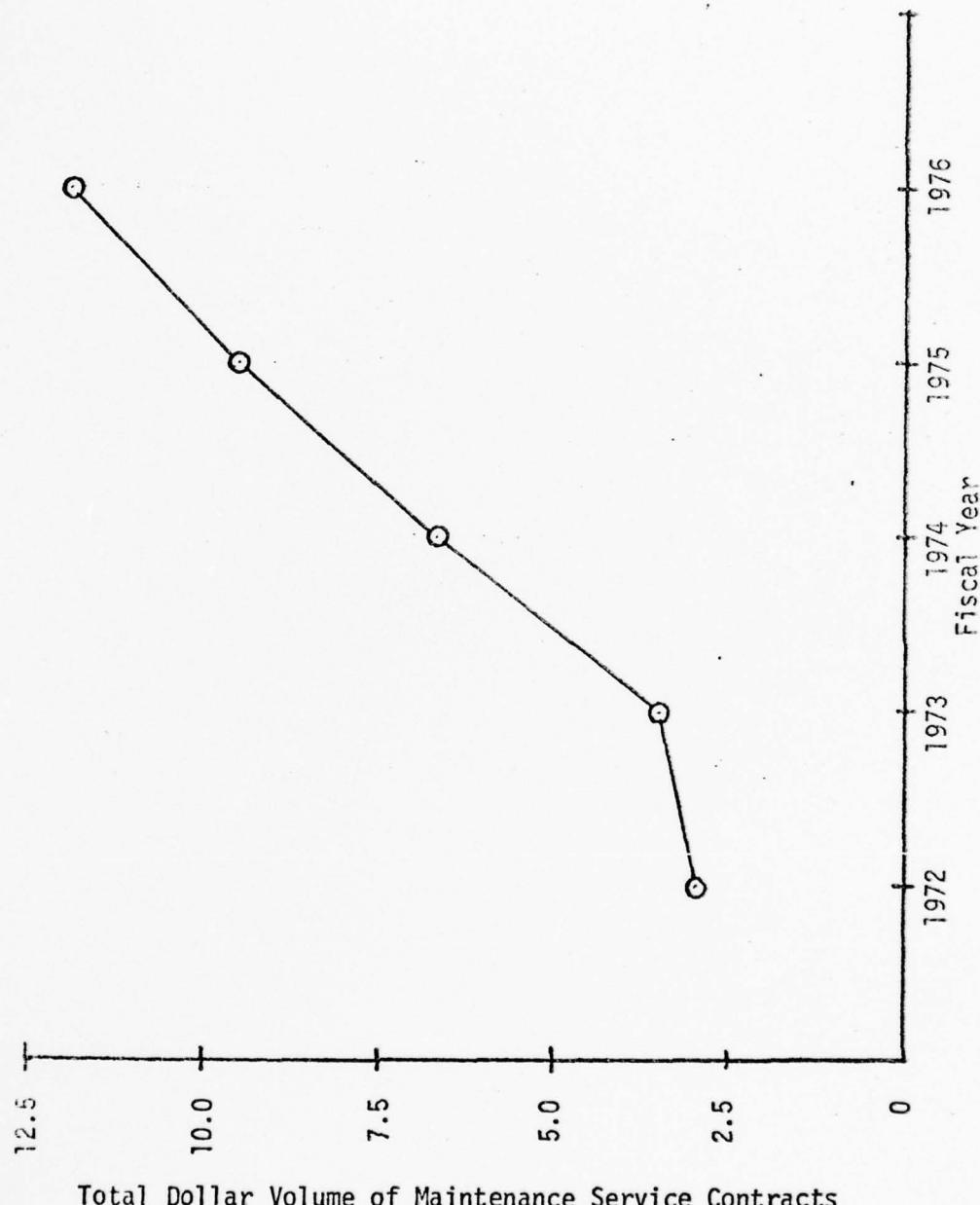


Figure 3  
Variation of Dollar Volume MSC and Period  
FY 1972 - FY 1976

Null  $H_0$  There is no significant correlation between the size of the area where the activity is located and the number of poorly performing maintenance service contractors.

This hypothesis was tested utilizing items 1 and 12.

Item 1 - The population within a 25-mile radius of my activity is:

Less than 50,000 ( )  
50,000 to 100,000 ( )  
100,000 to 200,000 ( )  
200,000 to 500,000 ( )  
500,000 to 1,000,000 ( )  
More than 1,000,000 ( )

Item 12 - The geographical location of my activity provides a large number of potential bidders--a good portion of which do not have the resources, will, or expertise to satisfactorily perform under the terms of the contract.

10 9 8 7 6 5 4 3 2 1

A summary of statistics computed from respondent scores to item 12 is as follows:

$$\bar{X} = 4.5 \quad MD = 2.05$$

$$S^2 = 6.47 \quad S = 2.54$$

$$\mu = 10.0 \quad t_c = 9.68$$

Items 1 and 12 were both used to form the pairs of scores needed in the computation of the correlation coefficient  $r$  using the Pearson product-moment method and the associated  $t$  statistic. These computed values were calculated to be as follows:

$$\pi = .03$$

$$t_c = .13$$

Analysis based on items 1 and 12:

The value of  $\pi$  is not significantly different from zero. Additionally, the  $p$  value associated with the calculated value of  $t$  is reasonably high based on the hypothesis and therefore led to acceptance of the null hypothesis. Acceptance of the null hypothesis indicates that there is really no relation between geographical area and the number of poorly performing maintenance service contractors.

Conclusion based on items 1 and 12 and Overall Conclusion RHP III:

There is no significant correlation between the size of the area where the activity is located and the number of poorly performing maintenance service contractors.

#### RESEARCH HYPOTHESIS IV ANALYSIS

RHP IV There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and the Public Works Officers at other activities with respect to the degree of satisfaction with the performance of their various maintenance service contractors.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and the Public Works Officers at other activities with respect to the degree of satisfaction with the performance of their various maintenance service contractors.

This hypothesis was tested utilizing items 7 and 9.

Item 7 - Comparing the accomplishment of routine recurring maintenance work by maintenance service contract and by in-house forces,  
I feel that accomplishing the work by contract is:

Definitely Superior	Definitely Inferior								
10	9	8	7	6	5	4	3	2	1

A summary of statistics computed from respondent scores to item 7 is as follows:

$$\bar{X} = 6.4 \quad MD = 1.14$$

$$S^2 = 2.04 \quad S = 1.43$$

$$\mu = 3.0 \quad t_c = 10.63$$

Analysis based on item 7:

This item seeks to get some numerical rating from the various PWO's relating how they compare accomplishing routine maintenance work by the MSC or by doing it with in-house employees. The mean score for the twenty PWO's is 6.4 which implies that the group feels that accomplishing routine maintenance work by contract has a slight edge. On the other hand, the PWO El Toro attitude is that accomplishing this work by in-house forces is definitely preferable to doing it by contract.

Statistically comparing the opinion of the PWO at El Toro with the collective opinion of the other PWO's, the calculated value of  $t$  is large and translated to a  $p$  value much less than the  $p = .05$  level. On this basis it would be improbable that the two means come from the same sample and the Null  $H_0$  Hypothesis was rejected.

Conclusion based on item 7:

There is a significant difference of opinion between the twenty PWO's and the PWO at El Toro on the preferred method of accomplishing routine recurring maintenance.

Item 9 - If I made a general evaluation of the overall maintenance service contractor performance at my activity I would rate the performance as:

Highly Satisfactory	Unsatisfactory
10	9
8	7
6	5
4	3
2	1

A summary of statistics computed from respondent scores to item nine is as follows:

$$\begin{array}{ll}
 \bar{X} = 7.15 & MD = 1.18 \\
 S^2 = 2.34 & S = 1.53 \\
 \mu = 3.0 & t_c = 12.13
 \end{array}$$

Analysis based on item 9:

Similar to item 7, item 9 elicits a numerical rating from the PWO's as it describes their overall evaluation of maintenance service contractor performance at their activity. The mean score for item 9 is 7.15 which implies that most of the PWO's are generally satisfied with the performance of their maintenance service contractors. Conversely, the PWO at El Toro responded to this item with a score of 3.0, indicating a general dissatisfaction with the performance of his maintenance service contractors.

The statistical comparisons of the group opinion versus the individual PWO MCAS El Toro opinion relative to this item yields the same results essentially as did item 7; that is, the calculated  $t$  value

is large and translates to a  $p$  value that is much less than the accept criteria value of  $p = .05$ . On this basis, like item 7, the null hypothesis was rejected.

Conclusion based on item 9:

There is a significant difference of opinion between the twenty PWO's and the PWO at El Toro with regard to their degree of satisfaction with their various maintenance service contractors.

Overall Conclusion RHP IV:

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the degree of satisfaction with the performance of the various maintenance service contractors.

#### RESEARCH HYPOTHESIS V ANALYSIS

RHP V There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the need in the foreseeable future to utilize the maintenance service contract for recurring base maintenance.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the need in the foreseeable future to utilize the maintenance service contract for recurring base maintenance.

This hypothesis was tested utilizing item 8.

Item 8 - I feel that in the foreseeable future the need to use the maintenance service contract will:

Increase Significantly		Decrease Significantly							
10	9	8	7	6	5	4	3	2	1

A summary of statistics computed from respondent scores to item 8 is as follows:

$$\bar{X} = 8.65 \qquad \qquad MD = 1.05$$

$$S^2 = 1.50 \qquad \qquad S = 1.22$$

$$\mu = 8.0 \qquad \qquad t_c = 2.38$$

Analysis based on item 8:

The mean score for the twenty responding PWO's to item 8 was 8.65. The score by the PWO at El Toro was 8.0. These scores reflect a strong opinion among all of the PWO's that there will be a continuation of the trend toward the utilization of the maintenance service contract in the foreseeable future.

In statistically comparing the collective opinion of the twenty PWO's and that of the PWO at El Toro, the null hypothesis would be rejected based on the  $p = .05$  criterion. However, if the criterion was  $p = .02$  the null hypothesis would be accepted. Additionally, if the PWO El Toro had responded with a score one category higher (9.0 vice 8.0), then statistically the null hypothesis would be rejected on the  $p = .05$  criterion.

Based on the more or less arbitrary assignment of the probability criterion ( $p = .05$ ), and the obvious central tendency around the 8.65 mean, it would appear that the opinion of the PWO at El Toro is right in line with the collective opinion of the other PWO's and that a

rejection of the null hypothesis, although statistically accurate, would be misleading from a subjective point of view. In view of the overall scores on this item it seems the most logical analysis and judgment would be to accept the null hypothesis. However, to be consistent with established criteria, the null hypothesis was rejected.

Conclusion based on item 8 and Overall Conclusion RHP V:

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and the PWO's at other activities with respect to the need in the foreseeable future to utilize the maintenance service contract for recurring base maintenance.

#### RESEARCH HYPOTHESIS VI ANALYSIS

RHP VI There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution made by the Navy-Marine Corps policy of low bidder award to the number of contractors who render marginal or less than satisfactory performance.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution made by the Navy-Marine Corps policy of low bidder award to the number of contractors who render marginal or less than satisfactory performance.

This hypothesis is tested utilizing item 10.

Item 10 - I feel that the Navy-Marine Corps policy requiring acceptance of low conforming bidder contributes to the number of contractors who provide marginal or less than satisfactory service and that this contribution is:

Significant	Insignificant
10    9    8    7    6    5    4    3    2    1	

A summary of statistics computed from respondent scores to item 10 is as follows:

$$\begin{array}{ll}
 \bar{X} = 6.89 & MD = 2.24 \\
 S^2 = 6.87 & S = 2.62 \\
 \mu = 9.0 & x_c = 3.51
 \end{array}$$

Analysis based on item 10:

Observation of the spread of scores responding to this item shows almost a bimodal distribution. Because of this distribution there is certainly no consistency of opinion among all respondents. The mean score does indicate a majority opinion supporting the statement that the low bidder policy is influential. Twelve of the respondent scores were located in the seven or higher category with ten of those being in the eight or higher category. Based on this widely varying distribution it is accurate to say that a substantial number of respondents were of the belief that this factor is very definitely significant in contributing to less than desirable maintenance service contractor performance.

A statistical comparison of how the MCAS El Toro PWO opinion compares with the collective opinion of other PWO's delivers a calculated value of  $t$  equaling 3.51. Based on the  $p = .05$  criteria and the

calculated value of  $t$ , the null hypothesis should be rejected, considering the comparison between all respondents. If the high side mode were used as a basis for comparison the results could be different; but because of the lack of central tendency overall, it was considered appropriate to reject the null hypothesis and conclude there is a significant difference between the opinion of the PWO at MCAS El Toro and other PWO's.

Conclusion based on item 10 and Overall Conclusion RHP VI:

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution made by the Navy-Marine Corps policy of low bidder award to the number of contractors who render marginal or less than satisfactory performance.

#### RESEARCH HYPOTHESIS VII ANALYSIS

RHP VII There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the quality-soundness-completeness of the contract document and its contribution to the quality-quantity of the maintenance service contractors' performance.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the quality-soundness-completeness of the contract document and its contribution to the quality-quantity of the maintenance service contractors' performance.

This hypothesis was tested utilizing item 11.

Item 11 - I feel that the influence the quality-completeness of the contract document has on the quality-quantity of the contractor performance is:

Significant	Insignificant
10    9    8    7    6    5    4    3    2    1	

A summary of statistics computed from respondent scores to item 11 is as follows:

$$\begin{array}{ll}
 \bar{X} = 7.35 & MD = 1.48 \\
 S^2 = 3.5 & S = 1.9 \\
 \mu = 6.0 & t_c = 3.18
 \end{array}$$

Analysis based on item 11:

More than half of the responding PWO's (12 out of 20) marked their score to this item in the 8, 9, or 10 category. The remaining eight respondents scored their replies in a scattered fashion between the scores of 4 and 7 inclusive. The mean score for all twenty respondents is 7.35 which indicates that the collective opinion supports the belief that the quality of the contract document does influence maintenance service contractor performance. Further, the observation can be made that a sizable portion of the responding PWO's (12 out of 20) feel strongly that this contract document is indeed significant.

The PWO at El Toro provided essentially a middle-of-the-road opinion here indicating that he does not feel that the contract document quality carries much weight in influencing maintenance service contractor performance.

Statistical comparison of the PWO El Toro opinion and the collective other PWO opinion led to a rejection of the null hypothesis, based on the  $p = .05$  criteria.

Conclusion based on item 11 and Overall Conclusion RHP VII:

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the quality-soundness-completeness of the contract document and its contribution to the quality-quantity of the maintenance service contractors' performance.

#### RESEARCH HYPOTHESIS VIII ANALYSIS

RHP VIII There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether or not organizational adjustments and personnel resource commitments to maintenance service contract administration have kept pace with the change in utilization of the maintenance service contract.

Null  $H_0$  There is no significant difference of between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether or not organizational adjustments and personnel resource commitments to maintenance service contract administration have kept pace with the change in utilization of the maintenance service contract.

This hypothesis was tested utilizing the responses and data from three items: 5, 13, and 17.

Item 5 - The following numbers of personnel are assigned to my Public Works and OICC-ROICC organization:

PUBLIC WORKS		OICC-ROICC	
Civilian	Military	Civilian	Military

Analysis based on item 5:

Item five simply asked each PWO-OICC to list the size of his Public Works and OICC staffs. Because the different activities surveyed vary widely in their organizational configuration for contracts and base maintenance, a direct activity by activity comparison is not attempted in an effort to accept or reject the corresponding hypothesis. Rather, the data provided by this question are utilized in a more subjective fashion for reinforcing or questioning those observations and conclusions drawn from analyzing the data in items 13 and 17.

Conclusions based on item 5:

No specific conclusions were drawn based entirely on the data provided by this item.

Item 13 - At this activity organizational adjustments and personnel resource commitments have not kept pace with the growing utilization of the maintenance service contract.

Strongly Agree	Strongly Disagree
----------------	-------------------

10	9	8	7	6	5	4	3	2	1
----	---	---	---	---	---	---	---	---	---

A summary of the statistics computed from respondent scores to item 13 is as follows:

$$\begin{array}{ll} \bar{X} = 6.37 & MD = 2.03 \\ S^2 = 5.92 & S = 2.43 \\ \mu = 7.0 & t_c = 1.16 \end{array}$$

Analysis based on item 13:

There is a sizable variance in the respondent scores to this item, indicating an associated sizable variance in opinion among the PWO's on the matter of organizational resource realignment. The mean score for the twenty (19 in this item) was 6.37, which indicates a collective opinion slightly on the "strongly agree" side of the spectrum but not really far enough that way to be convincing. Additionally, the spread of scores adds to the "less than convincing" analysis.

The PWO at El Toro responded with a score of 7.0 placing his opinion close to the collective opinion of the other PWO's. Statistical analysis in comparing the PWO El Toro opinion with that of the other PWO's led to an acceptance of the null hypothesis based on the  $p = .05$  criterion.

Conclusion based on item 13:

There is no significant difference between the opinion of the PWO at MCAS El Toro and the other responding PWO's with respect to whether or not organizational adjustments and personnel resource commitments to maintenance service contractor administration have kept pace with the growing utilization of the maintenance service contract.

Item 17 - I feel that the number of personnel assigned directly to the functions of administering the maintenance service contract is sufficient-insufficient for the number of MSC's at this activity.

Sufficient	Insufficient
10    9    8    7    6    5    4    3    2    1	

A summary of statistics computed from respondent scores to item 13 is as follows:

$$\begin{array}{ll}
 \bar{X} = 5.3 & MD = 2.6 \\
 S^2 = 8.75 & S = 2.96 \\
 \mu = 4.0 & t_c = 1.96
 \end{array}$$

Analysis based on item 17:

The spread of scores in response to this item is widely scattered and has very little central tendency. Accordingly, a wide range of PWO opinion related to this item is indicated. The data are certainly not conclusive toward either end of the spectrum. The mean score for the twenty responding PWO's is 5.3 or almost precisely mid-range, and there is at least one response in each score category 1 - 10. The score registered (4.0) by the PWO at El Toro is likewise near the middle of the road and when compared statistically with the other PWO's the null hypothesis necessarily was accepted at the  $p = .05$  probability level. It is interesting to note that because of the wide variance of the scores for this item, the PWO at El Toro could have responded with a score of 4, 5 or 6 (6.7 to be precise) and statistically this response would have resulted in acceptance of the null hypothesis.

Conclusion based on item 17:

There is no significant difference between the opinion of the PWO at El Toro and the collective opinion of PWO's at other activities relative to the sufficiency-insufficiency of numbers of MSC administrative personnel.

Overall Conclusions RHP VIII:

There is no significant difference of opinion between the PWO at MCAS El Toro and PWO's at other activities with respect to whether organizational adjustments and personnel resource commitments have kept pace with the change in utilization of the maintenance service contract.

RESEARCH HYPOTHESIS IX ANALYSIS

RHP IX There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution to marginal-unsatisfactory contractor performance made by lack of procedural detail and direction from the service level specifically addressing maintenance service contract administration.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution to marginal-unsatisfactory contractor performance made by lack of procedural detail and direction from the service level specifically addressing maintenance service contract administration.

This hypothesis was tested utilizing item 14.

Item 14 - If there were more definition and direction from the service level specifically related to the administration of the maintenance service contract, I feel my activity would benefit:

Greatly Not at all

10 9 8 7 6 5 4 3 2 1

A summary of statistics computed from respondent scores to item 14 is as follows:

$$\bar{X} = 8.0 \quad MD = 1.50$$

$$S^2 = 3.16 \quad S = 1.78$$

$$\mu = 8.0 \quad t_c = 0.0$$

Analysis based on item 14:

The respondent scores to this question reflect a decided collective opinion that more service-level direction and procedural guidance is required for the administration of the service contract. The mean score from the twenty PWO's was an even 8.0. The score from the PWO at El Toro was precisely the same. The closeness of the PWO El Toro score to the mean of the other PWO's led to a statistical acceptance of the null hypothesis.

Conclusions based on item 14 and Overall Conclusion RHP IX:

There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution to marginal-unsatisfactory contractor performance made by lack of procedural detail and direction from the service level specifically addressing maintenance service contracting.

#### RESEARCH HYPOTHESIS X ANALYSIS

RHP X There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the statement that the level of utilization of the maintenance service contract now and in

the foreseeable future is of a magnitude that uniform procedures for their administration should be established at the service level.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the statement that the level of utilization of the maintenance service contract now and in the foreseeable future is of a magnitude that uniform procedures for their administration should be established at the service level.

This hypothesis was tested utilizing item 15.

Item 15 - The current level of utilization of maintenance service contracts by Navy-Marine Corps activities is of such magnitude that more directives and procedures promulgated from the service level is:

Absolutely Necessary	Unnecessary
10	
9	
8	
7	
6	
5	
4	
3	
2	
1	

A summary of statistics computed from respondent scores to item 15 is as follows:

$$\bar{X} = 7.85 \quad MD = 1.70$$

$$S^2 = 4.55 \quad S = 2.13$$

$$\mu = 8.0 \quad t_c = 0.31$$

Analysis based on item 15:

Respondent scores to this question reduce to a mean score of 7.85.

This response very definitely indicates a strong feeling among the PWO's

that additional directives from the service level is in fact needed to improve the overall performance realized by using the maintenance service contract.

The respondent score by the PWO at MCAS El Toro was in the 8.0 category and therefore extremely close to the mean score for the other twenty PWO's. Statistical comparison yielded a  $t$  score that called for the acceptance of the null hypothesis.

Conclusion based on item 15 and Overall Conclusion RHP X:

There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the real need for additional service level direction on the administration of the maintenance service contract.

#### RESEARCH HYPOTHESIS XI ANALYSIS

RHP XI There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether or not the absence of directives from higher authority has contributed to similar inaction at the activity level to establish an adequate maintenance service contract administration organization.

Null  $H_0$  There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether or not the absence of directives from higher authority has contributed to similar inaction at the activity level to establish an adequate maintenance service contract administration organization.

This hypothesis was tested utilizing item 16.

Item 16 - The absence of directives from higher authority establishing procedures for the specific administration of the maintenance service contracts has contributed significantly to local lethargy in establishing an effective organizational effort for the administration of the MSC.

Strongly Agree

Strongly Disagree

10      9      8      7      6      5      4      3      2      1

A summary of statistics computed from respondent scores to item 16 is as follows:

$$\bar{X} = 5.2 \quad MD = 2.3$$

$$S^2 = 7.51 \quad S = 2.74$$

$$\mu = 5.0 \quad t_c = 0.33$$

Analysis based on item 16:

There is a wide spread of opinion among the responding Public Works Officers with regard to the lack of procedural guidance from higher authority contributing to local activity-level lethargy in establishing an adequately staffed, effective maintenance service contract administrative organization. The scatter of scores certainly does not support a consistency of opinion and the mean score turns out to be right at mid-range. Likewise the PWO El Toro response was mid-range at 5; and when the statistical comparison was made, the calculated  $t$  score led easily to acceptance of the null hypothesis at the  $p = .05$  probability level.

Conclusions based on item 16 and Overall Conclusion RHP XI:

There is no significant difference between the opinion of the Public Works Officer at El Toro and Public Works Officers at other activities with respect to whether the absence of directives from higher authority has contributed to similar inaction at the activity level to establish an adequate maintenance service contract administration organization.

#### RESEARCH HYPOTHESIS GENERAL ANALYSIS

RHP G The growing trend toward utilization of the maintenance service contract is a fact at MCAS El Toro as well as a large number of other Navy and Marine Corps activities. The magnitude is such that the absence of appropriate organizational resources to administer these contracts is resulting in maintenance service contractor performance that is marginal or unsatisfactory to the Base Maintenance or Public Works Officer.

##### Analysis of the general hypothesis:

Instead of evaluating this general hypothesis as was done with the individual specific hypotheses, the general hypothesis was subjected to evaluation based on observation and judgments of the scores and mean scores of several different questions considered to be relative to it. Most of the questions considered germane to the general hypothesis have been evaluated at least once as they relate to one or more of the specific hypotheses. Evaluation relative to the general hypothesis was attempted by identifying or attempting to identify some collective attitude of the responding PWO's toward the factors composing the general hypothesis. It did not attempt in this case to determine the degree of

agreement-disagreement between that collective attitude or opinion of the twenty PWO's and the opinion of the Public Works Officer at El Toro.

The phrases representing basic elements of the general hypothesis and the individual questions which serve to reflect PWO attitude on these elements are shown below:

". . . increasing trend in utilization of the MSC at El Toro and other activities. . . . "

Related items: 4, 6, and 8

Mean scores from each of the above items are as follows:

Item 4	No mean.	$r = 0.98$ , indicating a significant trend toward increased usage 1971-76.
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Item 6	$\bar{X} = 7.8$
--------	-----------------

Item 8	$\bar{X} = 8.65$
--------	------------------

It is apparent from the scores resulting from responses to the above items that growing utilization is significant at all activities and it is expected that this trend will continue.

". . . volume of maintenance service contract work has grown faster than personnel and organizational changes designed to adequately staff the MSC administration organization. . . . "

Related items: 13, 16, and 17

Mean scores for each of the above items are as follows:

Item 13	$\bar{X} = 6.37$
---------	------------------

Item 16	$\bar{X} = 5.2$
---------	-----------------

Item 17	$\bar{X} = 5.3$
---------	-----------------

From item 13 the mean score indicates a moderate amount of agreement with the statement that organizational adjustments and personnel resource realignments have not taken place at the same pace as the

growing usage of the maintenance service contract. Even though the mean score (6.37) is only moderately supportive of the "strongly agree" attitude, the fact remains there was a wide range of scores and several scores did in fact support a "strongly agree" finding. However, there was a good number who were reaching for the "strongly disagree" portion of the range and thus the mean score is somewhat near mid-range.

In a similar manner the respondent scores to items 16 and 17 had a large degree of scatter and corresponding higher values for variance  $S^2$ , and standard deviation  $S$ . Because of this response, the mean scores fell right at mid-range for both and the scores certainly do not indicate a convincing collective attitude either way. It is apparent for these two items, like item 13, that there are strong opinions both ways but statistically they essentially balance out. Statistical support of this element of the general hypothesis was not significant based purely on the analysis of mean scores of PWO responses.

". . . lack of adequate contract administration organization and personnel contributing to marginal or unsatisfactory maintenance service contractor performance. . . ."

Related items: 7, 9, and 18

Mean scores for each of the above items are as follows:

Item 7                     $\bar{X} = 6.4$

Item 9                     $\bar{X} = 7.15$

Item 18                     $\bar{X} = 8.75$

Utilizing these three items as a basis for making some judgment on this element of the general hypothesis, several observations may be made. From item 7 there is a moderate feeling among the twenty PWO's (PWO El Toro not included) that accomplishing routine recurring

maintenance by contract is slightly preferable to doing the same work in-house. Scrutiny of the data related to item 9 suggests that the majority of the PWO's are essentially satisfied with the performance they are getting from the various maintenance service contractors they employ. Again in item 9, as in item 7, there is a significant difference between the collective PWO opinion and the opinion of the PWO at El Toro. It should likewise be noted that the central tendency in both items 7 and 9 is comparatively high suggesting more consistency of opinion among the PWO's (PWO El Toro not included) on these two items than on most of the others.

The data related to item 18 strongly suggest that the collective opinion of the PWO's believes the capability to inspect MSC work with government inspectors has a significant impact on the service contractor performance. The PWO at El Toro does not feel that the ability to inspect has a significant impact. The data collected relative to this item have the highest degree of central tendency of all the items and therefore indicate a high degree of consistency of opinion among the twenty PWO's.

Generally speaking, it cannot be said that there is Public Works Officer opinion (except the PWO El Toro) which supports the attitude that a lack of organization and personnel resources have contributed significantly to poor service contractor performance because the data indicate basic satisfaction with the service contractor performance and even a slight preference for doing routine work that way as opposed to doing it in-house.

Overall conclusions on the general hypothesis:

1. There is indeed an ever-increasing trend in the utilization of the maintenance service contract for accomplishing routine recurring base maintenance.
2. The majority of PWO's (PWO MCAS El Toro not included) slightly prefer doing this routine recurring work by contract rather than with in-house forces.
3. The majority of PWO's (PWO MCAS El Toro not included) are essentially satisfied with the performance of their maintenance service contractors.
4. The majority of PWO's (PWO MCAS El Toro not included) feel that their ability to inspect the work of their maintenance service contractors contributes significantly to better performance.

## SUMMARY OF HYPOTHESES ANALYSIS

<u>HYPOTHESIS</u>	<u>CONCLUSION BASED ON ANALYSIS</u>
RHP I	There is a significant correlation between the number of maintenance service contracts and the number of years since 1971.
RHP II	There is a significant correlation between the dollar volume of maintenance service contracts and the number of years since 1971.
RHP III	There is no significant correlation between the size of the area where the activity is located and the number of poorly performing maintenance service contractors.
RHP IV	There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the degree of satisfaction with the performance of the various maintenance service contractors.
	Comment: PWO's at other activities reasonably satisfied; PWO at MCAS El Toro general dissatisfied.
RHP V	There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the

need in the foreseeable future to utilize the maintenance service contract for recurring base maintenance.

Comment: The PWO's at other activities feel more strongly about this need than does the PWO at MCAS El Toro.

RHP VI

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution made by the Navy-Marine Corps policy of low bidder award to the number of contractors who render marginal or less than satisfactory performance.

Comment: The PWO at El Toro feels strongly about this low bidder influence; other activity PWO's collective opinion is mixed.

RHP VII

There is a significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the quality-soundness-completeness of the contract document and its contribution to the quality-quantity of the maintenance service contractors' performance.

Comment: Majority of the other activity PWO's feel this influence is significant; the PWO at MCAS El Toro feels that there is only minor influence realized from this factor.

RHP VIII      There is no significant difference of opinion between the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether organizational adjustments and personnel resource commitments have kept pace with the change in utilization of the maintenance service contract.

Comment: Consistency of opinion in response to this hypothesis is varied and inconclusive.

RHP IX      There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the contribution to marginal-unsatisfactory contractor performance made by the lack of procedural detail and direction from the service level specifically addressing maintenance service contract administration.

Comment: Majority PWO opinion (including the PWO El Toro) is that activities would benefit significantly with more service-level direction on the administration of the maintenance service contract.

RHP X      There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to the real need for additional service level direction in the administration of the maintenance service contract.

RHP XI

There is no significant difference between the opinion of the Public Works Officer at MCAS El Toro and Public Works Officers at other activities with respect to whether the absence of direction from higher authority has contributed to similar inaction at the activity level regarding the establishment of an adequate maintenance service contract administration organization.

Comment: Consistency of opinion in response to this hypothesis is varied and inconclusive.

RHP G

1. There is indeed an ever-increasing trend in the utilization of the maintenance service contract for accomplishing routine recurring base maintenance.

2. The majority of PWO's (PWO MCAS El Toro excluded) slightly prefer doing this routine recurring work by contract as opposed to in-house forces.

3. The majority of PWO's (PWO MCAS El Toro excluded) are essentially satisfied with the performance of their maintenance service contractors.

4. The majority of PWO's (PWO MCAS El Toro excluded) feel that their ability to inspect the work of their maintenance service contractors contributes significantly to better performance.

## Chapter 5

### CONCLUSIONS AND RECOMMENDATIONS

Conditions and situations surrounding the utilization of the maintenance service contract at MCAS El Toro, California, led to an effort to more fully examine these conditions and situations and to hopefully find ways by which contractor performance could be improved. The methodology by which this examination and research have taken place was described earlier in Chapter 3.

The factors and variables describing the current experience with the maintenance service contract as well as factors possibly influencing contractor performance were the basis for formulating twelve hypotheses for this research. These hypotheses were tested through the data provided by 21 Public Works Officers via an eighteen-item questionnaire. The analysis of the data and the conclusions reached relative to each hypothesis are described and summarized in Chapter 4. The information contained in this chapter represents an attempt to translate the conclusions reached in Chapter 4 to some meaningful and achievable recommendations relative to each condition or influencing factor.

#### Utilization of the Maintenance Service Contract

The conclusions reached based on analysis of the general hypothesis as well as specific hypotheses I, II, and V document and support the fact that the Public Works Officers have been increasing their reliance on the maintenance service contract to accomplish routine

recurring base maintenance. Hypothesis V additionally supports the prognostication that this trend will continue.

The peacetime conditions influencing Department of Defense personnel levels and the Office of Manpower and Budget policy to "contract out" are no doubt the prime movers influencing this trend. Based on what can be predicted about the future, it is only reasonable to assume that unless either or both of these two dominant conditions are reversed, the trend in utilization will continue. This growing expenditure of dollars for contracted services for facilities maintenance has reached an order of magnitude that demands effective and innovative management if the American taxpayers' interests are to be protected. To be sure, DOD is heavily committed to accomplishing its base maintenance functions via the maintenance service contract method. Consequently constant attention must be given to this area of management and administration of this type government procedure. The talent maintained in this area must be consistent with the dollar level and resources commitment to the service contract. Proper manning on the government side is mandatory if the government is to get what it is paying for. Constant monitoring by capable management should show continued improvement and with such a commitment of talent, those factors leading to poor contractor performance should start to identify and diminish. However, it will not happen by itself; the talent must be placed in such a manner as to make it happen.

It is suggested that just as the federal government has made its policy commitment to contracting out for services that includes routine recurring base maintenance, it needs to make an equal policy commitment to management techniques and personnel resource allocation which will

allow the most-effective administration of these contracts.' Subsequent recommendations in this chapter suggest positive actions mainly confined to the authority of the activity commander. If, however, effective utilization of the MSC is to be a reality, actions must be taken at all levels to insure the desired level of efficiency is achieved and maintained.

Level of Public Works Officer Satisfaction  
With Maintenance Service Contractor

It has been stated several times earlier that a prime mover in pursuing this research was general dissatisfaction with the maintenance service contract effort at MCAS El Toro and with the quality of work received from the dozen or so maintenance service contractors at that activity. Item 9 of the questionnaire directly queried each Public Works Officer on his overall evaluation of the service contract effort at his activity. The collective evaluation was considerably higher than that evaluation made by the PWO at El Toro. The statistical analysis of Hypothesis IV yielded a significant difference of opinion on this particular item. If the question had been phrased slightly differently so that it asked for a comparison between doing this type of work in-house or by contract, it could very well have been more illuminating and more definitive on the degree of satisfaction. Regardless, probably the best description of what the collected data provide is to state that "PWO's at other activities are reasonably well satisfied and the PWO at El Toro is generally dissatisfied." Even though the particular item attempting to gather information on the level of satisfaction supports a "reasonably satisfied" description, from responses to other items exploring other factors of influence, it is obvious that the PWO's feel there is much

that needs to be done and can be done to improve the service contracting effort.

#### Population Density Surrounding Military Installation

One of the elements considered in this research was the contribution to the maintenance service contractor performance made by the size and composition of the metropolitan area surrounding the military installation. In other words, did a large metropolitan area such as Los Angeles contain a preponderance of potential service contractors and thereby intensify the competition to the point where the low bidder award factor would in most cases leave the contracting officer with a contractor who bid so low that he could not possibly do the work called for by the contract documents and show a profit at the same time? In most cases a contractor finding himself in such a situation for whatever reason would choose first to maintain his solvency and gamble on how little work he could do while continuing to get paid for it. The Public Works Officer at El Toro felt very strongly about this factor's influence on the quality of contractor he could hire, but the responses by the other PWO's definitely did not support this position and no significant correlation was found based on the data collected.

#### Quality of Contract Documents

Hypothesis VII in conjunction with item 11 indicated a significant difference of opinion between the PWO at MCAS El Toro and the other PWO's with respect to the importance of the quality of the maintenance service contract documents. This difference, however, basically is that the large majority of the responding PWO's feel that the contract

document has more importance than does the PWO at El Toro. Observation of the data relative to this factor certainly indicates that overall the belief is that preparation of a quality contract document aids in the realization of a better quality of work from the service contractor. While a quality contract document is not a panacea for solving all of the problems associated with maintenance service contracting, it does establish conditions under which extracting quality performance from a contractor is made easier. This of course assumes that the potential for quality performance is already there. The contractor and contracting officer's jobs are indeed easier and more productive if the purchased services and the conditions under which they are to be performed are well defined for all.

The preparation of the contract document or documents is an activity-level responsibility; and as a result this facet of service contracting is one area where the activity can help itself. The Public Works Officer is definitely in the advantageous position if he has within his organization an individual or individuals who can produce a quality set of maintenance service contract specifications. By not maintaining such a capability, the PWO is denying himself the ability to locally influence his maintenance service contracting effort.

Additionally, NAVFAC P-34 contains maintenance service-types of specifications which give the activity-level specification writer a head start in getting a quality document.<sup>1</sup>

It is suggested that activity-level effort be established to maintain the ability to produce quality contract documents through

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<sup>1</sup>Naval Facilities Engineering Command, Design Criteria Used in Contracts for Public Works (April, 1977), p. 9.

proper resource allocation and maximum utilization of existing maintenance service-types of specifications.

#### Award to the Low Conforming Responsible Bidder

The factor requiring award to the low conforming bidder was examined with Hypothesis VI and item 10. The statistical conclusion on this hypothesis stated a significant difference between the opinion of the PWO at MCAS El Toro and the collective opinion of the other twenty PWO's with respect to the influence of this factor. Even though the statistical criteria were not satisfied and the "significant difference" was declared, it is apparent that a good portion of the respondents did feel strongly about the influence of this factor as did the PWO at El Toro. See the respondent data sheet Page 107 in Appendix B. Because of this obvious feeling by a good number of the respondents, certain comment on this factor is probably warranted.

The Armed Services Procurement Regulation and its derivative, NAVFAC P-68, requires that formally advertised contracts be awarded to the low conforming responsible bidder.<sup>2</sup> Formally advertised contracts are applicable to the maintenance service contract as well as to construction and other varieties of procurement contracts.

The low bidder award policy has long been an area of criticism relative to government procurement procedures. The regulations do, in fact, contain all of the rhetoric and direction that guides the contracting officer to a determination of the "low conforming responsible bidder." However, the realities of implementing these rules and regulations for such determination produce, all too often, an award to the

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<sup>2</sup>Naval Facilities Engineering Command, Contract Administration Manual--CHG 3 (June, 1973), p. 4.7.1.

contractor who is in fact the low bidder but who is not necessarily conforming or responsible. Determination of a conforming and responsible bidder is, to be sure, a science that is less than precise.

Compliance with the ASPR's for low bidder award in the service contract area seemingly produces more "low bidders" who are neither conforming nor responsible but who, nevertheless, get the award based on the low bid. Many reasons could contribute to this condition but in general the maintenance service contractor population contains fewer resources, less managerial talent, and a larger portion of workers identified with lower skill levels. Bidders drawn from such a population increase the probability of being trapped by the low bidder regulation and thereby being stuck with the contractor who either cannot perform or who will not perform once a money-losing situation becomes obvious to him. In such a situation both contractor and government lose. The unfortunate part is that, in many cases, pre-award judgment on a contractor's ability to perform or not perform can be made with some degree of confidence. However, the simple determination that he cannot perform, at least in the OICC's judgment, is not grounds for selecting the next-higher bidder. Documenting evidence sufficient to disqualify a contractor requires such a mountain of paperwork and just plain administrative red tape that most OICC offices are not capable of handling it. The result is that the low bidder wins again and the government will not get what it bargained for.

One indicator by which a contracting officer may judge a contractor's ability to perform is a cost comparison between the contractor's bid price and the government estimate. Each formally advertised contract is accompanied by a government estimate, although that estimate is not

available to potential bidders. In some cases, the low bidder has bid a price which is less than 50 percent of the government estimate. This does not mean that the government estimate is sacrosanct. In many instances it is conservative, but in most all cases it does include estimates for all things which are required by the contract, including such things as required labor rates, paid holidays, and insurance, as well as the items of work to be provided. Bid estimates substantially lower than the government estimate give cause to suspect the bidder for a myriad of potential reasons: he does not understand the scope of the work; he does not have an effective method for estimating costs to do all of the required work; he intends to recoup with change orders after the award; or he does not plan to do all of the work he expects to be paid for. All of these potential reasons are cause to question the ability of the contractor, but they are not grounds on which his bid can be rejected after it has been confirmed. Once under contract, the means by which he will attempt to recover from a too-low bid will begin to be identified. Whatever means he chooses will be less than satisfactory to the contracting officer or to the customer receiving the services.

It would seem that some modifications of the ASPR's surrounding the low bidder concept are long overdue. It would also seem that such modifications should include provisions for permitting the local contracting officer to be more selective in his solicitation of potential bidders, have more authority in accepting or rejecting bidders, have more flexibility in negotiating contracts, and have more flexibility in awarding contracts based on formally advertised and competitively bid.

It is recommended that Congressional and service-level action be taken to modify and expand the Armed Services Procurement Regulations to make them more applicable to service contracting with particular emphasis on expanding local contract officer authority relative to

1. Acceptance-rejection of bids,
2. Negotiated as well as formally advertised contract award, and
3. Utilization of a restricted bidder list with proven performance.

#### Service-Level Action and Organizational Adjustments

Service-level action and organizational adjustments were explored utilizing several specific hypotheses (VII, IX, X, and XI). The conclusions surrounding the impact of these factors probably could be best summarized in a fairly general way. The collective PWO opinion only moderately supported the idea that organizational adjustments at their activity have not kept pace with the expanding utilization of the service contract. On the other hand, they were much more supportive of the idea that more service-level direction and attention is needed in the service contract area and, if it is realized, in all probability their activity will certainly benefit; and the areas that would benefit would include those requiring organizational realignment and adjustments in the allocation of personnel resources.

The service contract, unlike the construction contract, requires a slight modification of contract administration responsibilities and procedures. The Naval Facilities Engineering Command (NAVFAC) administers construction contracts for the Navy and Marine Corps through its various Engineering Field Divisions, OICC's and ROICC's. For these

services, the NAVFAC organization is reimbursed by the Navy or Marine Corps command sponsoring the construction. Services rendered under this concept involve the total spectrum of construction contract administration including advertising and awarding the contract, inspecting and certifying the work, initiating progress payments to contractors, and affecting change orders. The same NAVFAC organization provides contract administration services for the maintenance service contract; however, these services are not quite the same, and that difference could very well be a factor related to lethargic organizational adjustments and reallocation of resources. Essentially, the difference lies in the fact that since base facilities maintenance is an activity responsibility paid for by O&M dollars, the activity likewise has the responsibility for inspecting and certifying that work accomplished with the maintenance service contract. The local OICC organization does provide certain other services such as advertising, award, and payment, but does not inspect the work or certify that it has been done for payment purposes. The OICC and NAVFAC organizations do not have the responsibility for these functions nor are they staffed to do it.

A large number of maintenance service contracts have their genesis with the commercial industrial review process wherein the determination is made that "contracting out" is less costly to the government than providing the same service in-house. Once this determination has been made, the following sequence of events takes place:

- A. The in-house personnel billets identified with the function are eliminated from the activity Table of Allowance.
- B. The function or service is not eliminated but acquired through the service contract.

- C. The station or activity receives the service from the successful "low bidder."
- D. The local OICC awards and administers the contract, the administration of which does not include inspection and work certification unless provided by the station.

In most cases, the reality of converting a function from in-house to contract does not preserve necessary personnel billets which can be redesignated and reassigned to pick up the additional inspection-work certification requirements the activity has gained by turning to the MSC. At El Toro, over the five-year period investigated in this research, the service contract volume increased to approximately a dozen different contracts and an annual dollar volume exceeding half a million dollars. During this same time frame, no formal organizational commitment was made to establish an adequate inspection force. Some inspection efforts were made over these years, but principally after a contract was already in trouble and certainly not by personnel specifically and organizationally defined for that function. It appears that a failure to allocate resources so that inspector billets realized a commensurate increase with the number of service contracts was a rarity if it happened at all, not just at El Toro but at other activities as well. Because the responsibility for inspection and work certification is retained by the activity, proper personnel allowance modification must necessarily take place if total effective service contract administration is to be realized. The proper time for this identification and reallocation is at the time the decision is made to contract for a service rather than do it in-house. Further, the responsibility for

this identification is with the activity conducting the C/I review and for whom the service contractor will provide services.

The commercial industrial review process does not preclude the activity from making such identifications but current procedures do make it easy for the analyst to ignore such real world factors as the inspection requirement that are part of contracting out.

The activity PWO faces other potential pitfalls in complying with the requirements of the C/I review process. In the process of making the cost comparison between in-house and contracting out there are provisions within the current directives for the government to establish a "new start" if the cost analysis shows that it is cost favorable to the government to do the service in-house.<sup>3</sup> If such a determination is made then the requirement is also established to hire additional government employees to perform this new in-house function. The dichotomy is realized when the attempt is made to get the additional civilian positions to satisfy the requirement. Even though a cost analysis would justify such an action, the elements approving the results of the C/I review are not the same people who control personnel allowances. The situation is such that one can justify bringing a function back in-house or starting a new function in-house based on the cost analysis, but the reality of getting the personnel billets to activate such a plan is virtually impossible with today's declining DOD strength levels.

Instead of the current C/I review process providing the activity-level facilities manager the wherewithal to get his services the most cost-effective way, it really provides him with what is essentially an

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<sup>3</sup>Bureau of the Budget, Circular No. A-76, Revised (August, 1967), p. 1.

irreversible process designed to implement the contracting out philosophy expressed by OMB in Circular A-76. Recent changes in the directives for the review process increases factors associated with estimating in-house cost and further biases the review toward contracting out.<sup>4</sup>

Some of the above discussion attempts to illuminate a few of the areas surrounding the problems of properly organizing and staffing to cope with the increasing utilization of the maintenance service contract. This discussion is by no means all inclusive, but certainly supports the consensus of opinion that if activities are to achieve their dollars' worth from the MSC, there is a definite requirement to make organizational adjustments consistent with the requirements for adequate contract administration. Local action as well as action by higher authority can make the necessary contribution here.

At MCAS El Toro a personnel resource reallocation at the activity level has been effected to establish four inspector billets within the Public Works Department with full responsibility for inspection and work certification of MSC's. Preliminary results underscore the fact that this factor does favorably influence contractor performance.

At the service level it would appear that modification and clarification of the C/I review process should be made so that the end result is not necessarily the contracting out of a function and a concomitant reduction in an activity's civilian personnel billets, but rather a process by which the activity can most effectively exercise a make or buy decision and get the most for their tax dollar spent. The modifications should include necessary provisions whereby a "new start" is as easily

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<sup>4</sup>Commander Naval Material, Note 4860, Commercial or Industrial (C/I) Activities Program (December, 1976), p. 2.

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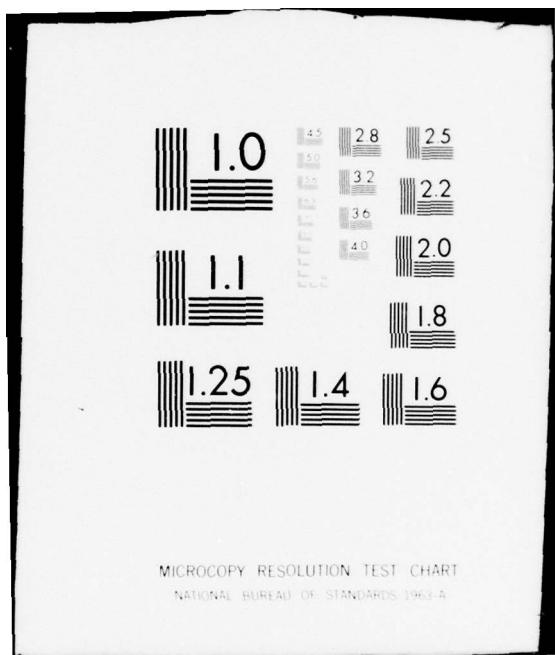
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achieved as contracting out and the existing irreversibility should be eliminated entirely.

The following recommendations are made regarding service-level actions and adjustments in organization:

1. Activity-level action to insure the maintenance service contract administration team is adequate for the level of service contracts administered.

2. Service-level action to achieve a more realistic commercial industrial review process--one which allows the activity to select the most cost-effective means of acquiring a service and one where the contracting-out method, if selected, insures reasonable provision for the activity to establish and maintain an adequate service contract administration organization through the reallocation and redesignation of personnel resources.

#### SUMMARY

This research examined a few factors which were considered to have some influence on the performance of maintenance service contractors at MCAS El Toro and possibly at other Navy-Marine Corps activities as well. Certain conclusions were reached and recommendations made regarding the results of this research. There are, no doubt, other factors which could be equally as influential as those explored herein. Some of the recommendations made have already been implemented at El Toro and possibly at other activities too. Regardless, contracting for maintenance services within DOD is "big business." It deserves more management attention than it has received in the recent past. Hopefully the contents of this paper will engender some improvement and serve as a catalyst for more exploration of those areas where further improvement and more-effective utilization of the maintenance service contract can be realized.

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APPENDIX A  
QUESTIONNAIRE

APPENDIX A

QUESTIONNAIRE

1. The population within a 25-mile radius of my activity is:

Less than 50,000	( )
50,000 to 100,000	( )
100,000 to 200,000	( )
200,000 to 500,000	( )
500,000 to 1,000,000	( )
More than 1,000,000	( )

2. Please indicate your current fiscal year Public Works budget in the following categories:

Functional Category Code (F.C.C.) "M"	_____
Functional Category Code (F.C.C.) "N"	_____
Functional Category Code (F.C.C.) "P"	_____
Functional Category Code (F.C.C.) "R"	_____
Functional Category Code (F.C.C.) " "	_____
Family Housing	_____
Other Reimbursables if significant	_____

3. Does your activity use the Maintenance Service Contract to accomplish any of your recurring maintenance work? YES/NO

4. If the answer to Item #3 is yes, list the number and dollar volume of your activity's maintenance service contract effort over the last five years as follows:

FY	NO. OF MSC's	TOTAL DOLLAR VOLUME
1976	_____	_____
1975	_____	_____
1974	_____	_____
1973	_____	_____
1972	_____	_____

5. The following numbers of personnel are assigned to my Public Works and OICC/ROICC organization:

Public Works		OICC/ROICC	
<u>Civilian</u>	<u>Military</u>	<u>Civilian</u>	<u>Military</u>
_____	_____	_____	_____

6. Over the past five years the number and dollar value of Maintenance Service Contracts at my activity have	Increased Significantly					Decreased Significantly				
	10	9	8	7	6	5	4	3	2	1
7. Comparing the accomplishment of routine maintenance work by Maintenance Service Contract and by in-house forces, I feel that accomplishing the work by contract is:	Definitely Superior					Definitely Inferior				
	10	9	8	7	6	5	4	3	2	1
8. I feel that in the foreseeable future the need to utilize the Maintenance Service Contract will:	Increase Significantly					Decrease Significantly				
	10	9	8	7	6	5	4	3	2	1
9. If I made a general evaluation of the overall Maintenance Service Contract performance at my activity I would rate the performance as	Highly Satisfactory					Unsatisfactory				
	10	9	8	7	6	5	4	3	2	1
10. I feel that the Navy/Marine Corps policy requiring acceptance of the low bidder contributes to the number of contractors who provide marginal or less than satisfactory service and that this contribution is:	Significant					Insignificant				
	10	9	8	7	6	5	4	3	2	1
11. I feel that the influence the quality/completeness of the contract document has on the quality/quantity of the contractor performance is:	Significant					Insignificant				
	10	9	8	7	6	5	4	3	2	1
12. The geographical location of my activity provides a large number of potential bidders - a good portion of which do not have the resources or the expertise to satisfactorily perform under the terms of the contract.	Strongly Agree					Strongly Disagree				
	10	9	8	7	6	5	4	3	2	1
13. At this activity, organizational adjustments and personnel resource commitments have not kept pace with the growing utilization of the Maintenance Service Contract.	Strongly Agree					Strongly Disagree				
	10	9	8	7	6	5	4	3	2	1

14. If there were more definition and directives from the service level specifically related to the administration of the Maintenance Service Contract I feel my activity would benefit:

Greatly					Not at all				
10	9	8	7	6	5	4	3	2	1

15. The current level of utilization of Maintenance Service Contracts by Navy/Marine Corps activities is of such magnitude that more directives and procedures promulgated from the service level is:

16. The absence of directives from higher authority establishing procedures for the specific administration of Maintenance Service Contracts has contributed significantly to local lethargy in establishing an effective organization effort for the administration of the Maintenance Service Contract.

<b>Strongly Agree</b>	<b>Strongly Disagree</b>
10    9    8    7    6    5    4    3    2    1	

17. I feel that the number of personnel assigned directly to the functions of administering the Maintenance Service Contract is sufficient/insufficient for the number of MSC's at this activity.

18. The relationship between the ability of the MSC staff's ability to inspect, certify work, etc., and the overall performance of the Maintenance Service Contractor is:

APPENDIX B

QUESTIONNAIRE RESPONSES

APPENDIX B  
QUESTIONNAIRE RESPONSES

ITEM 1

ACTIVITY NUMBER	50	50-100	100-200	X1000 200-500	500-1000	1000
1				X		
2						X
3					X	
4			X			
5						X
6		X				
7				X		
8						X
9				X		
10						X
11				X		
12						X
13						X
14		X				
15			X			
16		X				
17				X		
18		X				
19					X	
20		X				X

MCAS E1 TORO

## ITEM 4

## TOTAL NUMBER OF MAINTENANCE SERVICE CONTRACTS

ACTIVITY NUMBER	FISCAL YEAR				
	76	75	74	73	72
1	2	2	-	-	-
2	23	22	23	14	9
3	8	-	-	-	3
4	4	4	4	4	3
5	95	65	46	-	-
6	9	9	8	7	6
7	1	1	1	1	1
8	11	13	10	12	16
9	5	5	5	5	5
10	1	1	1	1	1
11	7	4	4	3	4
12	17	11	7	-	-
13	3	3	3	2	3
14	9	5	3	1	1
15	9	4	7	4	3
16	2	2	1	1	1
17	20	14	-	-	-
18	1	1	1	1	1
19	3	3	3	3	3
20	1	0	0	0	0
MCAS El Toro	<u>13</u>	<u>9</u>	<u>8</u>	<u>8</u>	<u>4</u>
TOTAL	244	178	135	67	63

## ITEM 4

TOTAL DOLLAR VALUE OF MAINTENANCE SERVICE CONTRACTS  
X1000

ACTIVITY NUMBER	FISCAL YEAR				
	76	75	74	73	72
1	61.8	64.0	-	-	-
2	555.8	734.6	562.5	300.9	194.4
3	1,500.0	1,312.5	1,125.0	937.5	750.0
4	113.0	82.0	73.0	127.0	120.0
5	1,950.0	1,700.0	1,500.0	-	-
6	392.5	363.4	330.6	296.0	212.7
7	345.5	296.0	246.0	194.5	212.6
8	418.8	329.5	291.2	411.0	127.1
9	385.0	360.0	348.0	295.0	283.0
10	19.0	19.0	17.0	15.0	-
11	888.5	760.6	810.0	268.2	618.7
12	429.0	272.6	122.3	-	-
13	10.0	12.4	4.7	1.7	2.4
14	507.0	445.6	314.3	88.5	50.0
15	207.7	138.4	207.1	90.7	111.4
16	20.0	18.0	9.0	7.0	7.0
17	3,126.0	1,804.0	-	-	-
18	146.0	91.9	83.9	90.4	67.9
19	192.7	259.6	123.7	114.6	96.1
20	21.7	-	-	-	-
MCAS El Toro	<u>614.2</u>	<u>452.4</u>	<u>450.7</u>	<u>234.4</u>	<u>128.9</u>
TOTAL	11,904.2	9,516.5	6,619.0	3,473.2	2,982.2

ITEM 6

ITEM 7

ACTIVITY NUMBER	Definitely Superior									Definitely Inferior	
	10	9	8	7	6	5	4	3	2	1	
1					X						
2									X		
3			X								
4				X							
5						X					
6			X								
7				X							
8						X					
9							X				
10					X						
11								X			
12						X					
13					X						
14					X						
15						X					
16						X					
17						X					
18						X					
19					X						
20							X				

## ITEM 8

ACTIVITY NUMBER	Increase Significantly	Decrease Significantly								
		10	9	8	7	6	5	4	3	2
1				X						
2					X					
3					X					
4			X							
5					X					
6						X				
7					X					
8		X								
9		X								
10				X						
11		X								
12				X						
13		X								
14				X						
15			X							
16				X						
17		X								
18					X					
19		X								
20						X				
MCAS El Toro				X						

## ITEM 9

ACTIVITY NUMBER	Highly Satisfactory	Unsatisfactory									
		10	9	8	7	6	5	4	3	2	1
1					X						
2					X						
3			X								
4			X								
5					X						
6	X										
7		X									
8			X								
9					X						
10			X								
11						X					
12							X				
13							X				
14			X								
15			X								
16				X							
17				X							
18					X						
19					X						
20						X					X

MCAS El Toro

ITEM 10

ITEM 11

ACTIVITY NUMBER	Significant									Insignificant		
	10	9	8	7	6	5	4	3	2	1		
1							X					
2			X									
3									X			
4				X								
5						X						
6				X								
7			X									
8				X								
9					*			X				
10			X									
11									X			
12				X								
13			X									
14				X								
15					X							
16									X			
17			X									
18					X							
19								X				
20				X						X		

ITEM 12

MCAS El Toro X

ITEM 13

ACTIVITY NUMBER	Strongly Agree								Strongly Disagree	
	10	9	8	7	6	5	4	3	2	1
1								X		
2			X							
3				X						
4					X					
5									X	
6			X							
7							X			
8		X								
9									X	
10						X				
11			X							
12									X	
13							X			
14			X							
15				X						
16						X				
17					X					
18										
19				X						
20								X		
					X					

ITEM 14

ACTIVITY NUMBER	Greatly										Not at All
	10	9	8	7	6	5	4	3	2	1	
1									X		
2			X								
3				X							
4					X						
5						X					
6				X							
7							X				
8			X								
9						X					
10				X							
11					X						
12			X								
13			X								
14				X							
15			X								
16						X					
17			X								
18							X				
19			X								
20								X			

## ITEM 15

ACTIVITY NUMBER	Absolutely Necessary							Unnecessary			
	10	9	8	7	6	5	4	3	2	1	
1									X		
2			X								
3								X			
4											X
5				X							
6					X						
7									X		
8				X							
9						X					
10					X						
11							X				
12			X								
13				X							
14					X						
15			X								
16								X			
17			X								
18									X		
19			X								
20										X	
MCAS E1 Toro							X				

ITEM 16

ACTIVITY NUMBER	Strongly Agree									Strongly Disagree	
	10	9	8	7	6	5	4	3	2	1	
1				X							
2			X								
3				X							
4									X		
5								X			
6										X	
7								X			
8						X					
9								X			
10						X					
11								X			
12					X						
13											X
14			X								
15		X									
16						X					
17								X			
18				X							
19											X
20								X			



## ITEM 18

ACTIVITY NUMBER	Significant	Insignificant									
		10	9	8	7	6	5	4	3	2	1
1	X										
2			X								
3				X							
4					X						
5						X					
6	X										
7			X								
8				X							
9			X								
10					X						
11	X										
12			X								
13	X										
14			X								
15	X										
16					X						
17	X										
18						X					
19	X										
20					X						
MCAS El Toro							X				

APPENDIX C

SAMPLE CALCULATIONS

APPENDIX C  
SAMPLE CALCULATIONS

Item 8 - Computation of Mean ( $\bar{X}$ ), Mean Deviation (MD), Standard Deviation (S), and Variance ( $S^2$ )

Scores $X$	Deviations from Mean $x = X - \bar{X}$	$\frac{x^2}{X}$
8	-.65	.42
8	-.65	.42
8	-.65	.42
9	.35	.12
8	-.65	.42
7	-1.65	2.72
8	-.65	.42
10	1.35	1.82
10	1.35	1.82
8	-.65	.42
10	1.35	1.82
8	-.65	.42
10	1.35	1.82
9	.35	.12
10	1.35	1.82
9	.35	.12
10	1.35	1.82
7	-1.65	2.72
10	1.35	1.82
6	-2.65	7.02
$\Sigma X = 173$		$\Sigma  x  = 21.0$
$\Sigma x^2 = 28.50$		

$$\bar{X} = \frac{\Sigma X}{n} = \frac{173}{20} = 8.65$$

$$MD = \frac{\Sigma |x|}{n} = \frac{21.0}{20} = 1.05$$

$$S^2 = \frac{\Sigma x^2}{n-1} = \frac{28.50}{19} = 1.50$$

$$S = S^2 = 1.50 = 1.22$$

$$\text{Calculate } t_c : \quad t_c = \frac{\bar{X} - \mu}{S/\sqrt{n}} = \frac{8.65 - 8.0}{1.22/\sqrt{20}} = \frac{.65}{1.22/4.47} = 2.38$$

Where:  $\mu = 8.0$  and  $d.f. = n - 1 = 19$

APPENDIX D  
PARTIAL DISTRIBUTION OF  $t$

APPENDIX D  
PARTIAL DISTRIBUTION OF  $\chi^2$

d.f.	p = .20	.10	.05	.02	.01	.002
1	3.08	6.31	12.70	31.80	63.60	318.30
2	1.89	2.92	4.30	6.97	9.93	22.30
3	1.64	2.35	3.18	4.54	5.84	10.20
4	1.53	2.13	2.78	3.75	4.60	7.17
5	1.48	2.02	2.57	3.37	4.03	5.89
16	1.34	1.75	2.12	2.58	2.92	3.69
17	1.33	1.74	2.11	2.57	2.90	3.65
18	1.33	1.73	2.10	2.55	2.88	3.61
19	1.33	1.73	2.09	2.54	2.86	3.58
20	1.33	1.73	2.09	2.53	2.85	3.55
$\infty$	1.28	1.645	1.96	2.33	2.58	3.09

Notes: 1. The p values are for a two-tailed test.  
 2. This table is an excerpt from Table 12 of the Biometrika Tables for Statisticians, Vol. 1 (ed. 1), edited by E. S. Pearson and H. O. Hartley.

APPENDIX E

LIST OF SYMBOLS

APPENDIX E  
LIST OF SYMBOLS

$d.f.$	Degree of Freedom
$MD$	Mean Deviation of twenty respondents
$\mu$	Mean score of sample set of one (Public Works Officer, MCAS El Toro)
$n$	Number of pairs of scores
$n$	Number of scores from respondents
$H_0$	Null Hypothesis
$p$	Probability Estimate
$r$	Correlation Coefficient
$RHP$	Research Hypothesis
$s$	Standard Deviation of twenty respondents
$s^2$	Variance of twenty respondents
$t$	Values of $t$ taken from the excerpt of the $t$ distribution table (Appendix D)
$t_c$	Calculated value of $t$ using the relationship $t_c = \frac{\bar{X} - \mu}{s/\sqrt{n}}$
$x$	Score of respondent
$\bar{x}$	Mean score of twenty respondents
$x$	Deviation from Mean Score, $\bar{x}$
$x^2$	Deviation from Mean Score, $\bar{x}$ , squared